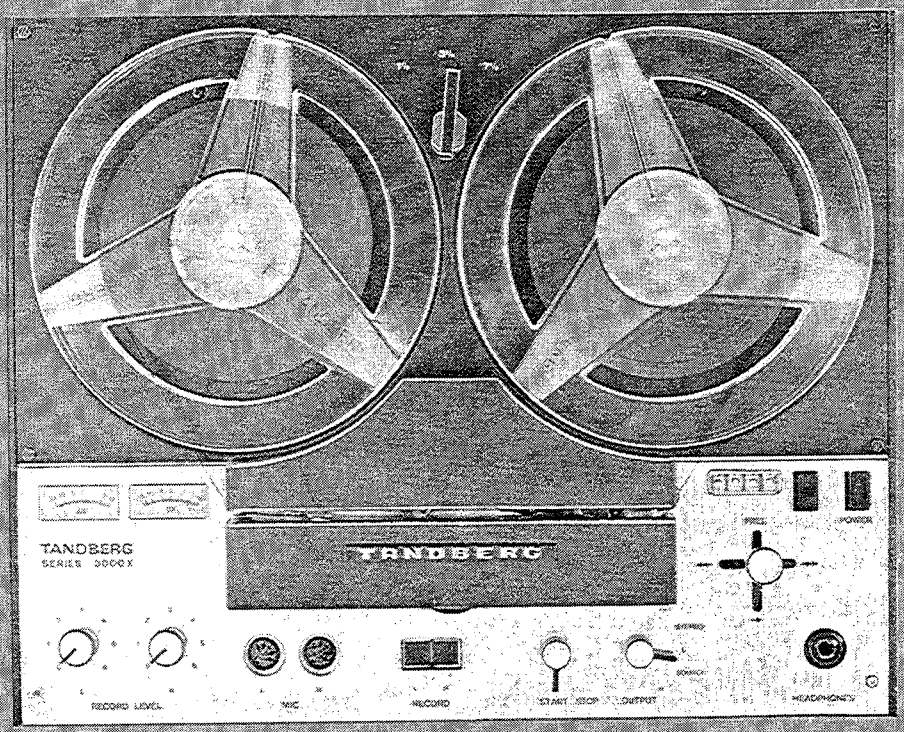
TANDBERG
Series 3000X

SERVICE MANUAL



TANDBERGS RADIOFABRIKK A/S

Contents

1.0 TECHNICAL SPECIFICATIONS 2

2.0 MECHANCIAL ADJUSTMENTS 4
2.1 Clutches 4
2.1.1 Take-up Turntable 4
2.1.2 Take-up Turntable 4
2.1.3 Supply Turntable 4
2.1.4 Supply Turntable 4
2.2 Brakes 5
2.3 Pressure Pad Adjustment 6
2.4 End Stop Mechanism 6
2.4.1 Tape Feeler Tension 6
2.4.2 Adjustment of Tape Feeler 6

3.0 ALIGNMENT 7
3.1 Demagnetizing 7
3.2 Bias- and Erase Circuits 7
3.2.1 Oscillator Frequency 7
3.2.2 Erase Voltage 7
3.2.3 Bias Current 7

4.0 TAPE PATH 8
4.1 Visual Check 8
4.2 Mechanical adjustment of tape path ... 8

5.0 HEAD ALIGNMENT WITH TANDBERG TEST TAPES, MODEL 3041X 9
5.1 Playback head 9
5.1.1 Height Adjustment 9
5.1.2 Azimuth Adjustment 9
5.2 Record Head 9
5.2.1 Height Adjustment by Visual Inspection 9
5.2.2 Height Adjustment by Track Measurement 9
5.2.3. Azimuth Adjustment 9
5.3 Bias Head 9
5.3.1 Vertical Adjustment 9
5.3.2 Height Adjustment 9
5.3.3 Horizontal Adjustment 9
5.4 Erase Head 9
5.4.1 Height Adjustment 9
5.4.2 Azimuth Adjustment 10
5.5 Model 3021X 10

6.0 HEAD ALIGNMENT WITHOUT TANDBERG TEST TAPES, MODEL 3041X 10
6.1 Playback Head 10
6.1.1 Height Alignment 10
6.1.2 Azimuth Alignment 10
6.2 Record Head 10
6.3 Bias Head 10
6.4 Erase Head 10
6.4.1 Height Adjustment 10
6.4.2 Azimuth Adjustment 10
6.5 Model 3021X 10

7.0 TRACK CONTROL 10
7.1 Model 3041X 10
7.1.1 Record Head 10
7.1.2 Erase Head 10
7.1.3 Playback Head 11
7.2 Modell 3021X 11
7.2.1 Erase Head 11
7.2.2 Record Head 11
7.2.3 Playback Head 11

8.0 ADJUSTMENT AND CONTROL OF THE AMPLIFIERS 11
8.1.1 Playback Level Adjustment 11
8.1.2 Adjustment of Bias Current 11
8.1.3 Record/Playback Level Adjustment 11
8.1.4 Record/Playback Curves 11
8.1.5 Distortion 11
8.1.6 Control of Playback Amplifier 11
8.2 Tape Speed Control 12
8.2.1 Using Frequency Meter or Counter 12
8.2.2 Using Transformer and Vacuum Tube Voltmeter 12
8.2.3 Using Tape of Known Length 12

9.0 RECORD/PLAYBACK CURVES 12
9.1 Readjustment of Record/Playback Level 12
9.2 Distortion 12
9.3 Control of Playback and Record Amplifiers 12
9.3.1 Playback Amplifier 12
9.3.2 Record Amplifier 13

10.0 MODIFICATIONS 15
10.1 Modifications from 115/130/230/240 V, 50/60 Hz Operation 15
10.2 Modification from Four-Track to Two-Track Version 15
10.3 Component Modification in Series 3000X 15

11. LUBRICATION 15

12.0 ILLUSTRATIONS WITH REFERENCE PART NUMBERS 16

13.0 SPARE PARTS LIST FOR MODEL 3000X ... 22
13.1 Mechanical Parts 22
13.2 Electrical Components 26

14.0 TABLE OF TRANSISTORS USED IN MODEL 3000X

15.0 BLOCK DIAGRAM FOR MODEL 3000X 28

16.0 PRINTED WIRING BOARDS AND WIRING DIAGRAM
16.1 European Version 28
16.2 U.S. Version 30

1.0 TECHNICAL SPECIFICATIONS

POWER REQUIREMENTS: 115—130—230—240 V. 50 or 60 Hz operation. See chapter 10.1 for voltage connections.

POWER CONSUMPTION: 45 watts.

MOTOR: Asynchronous.

TAPE SPEED: 1 7/8 ips, 3 3/4 ips and 7 1/2 ips.

TAPE: Maximum reel diameter 7". Low Noise Tape only should be used for recording and for adjustment procedure.

WINDING TIMES: 1200 ft. of tape: 1 3/4 min.
1800 ft. of tape: 2 1/2 min.

PLAYING TIME, MODEL 3021X: Two track recording on 1800 ft. of tape.

	Stereo	Mono
7 1/2 ips:	48 min.	2 × 48 min.
3 3/4 ips:	96 min.	2 × 96 min.
1 7/8 ips:	192 min.	2 × 192 min.

PLAYING TIME, MODEL 3041X: Four track recording on 1800 ft. of tape.

	Stereo	Mono
7 1/2 ips:	2 × 48 min.	4 × 48 min.
3 3/4 ips:	2 × 96 min.	4 × 96 min.
1 7/8 ips:	2 × 192 min.	4 × 192 min.

SPEED TOLERANCE: ± 1,5 %.

HEADS: Separate heads for erasure, recording, playback and bias (Tandberg Cross-field).

FREQUENCY RESPONSE: 7 1/2 ips: 40—20.000 Hz ± 2 dB
3 3/4 ips: 50—16.000 Hz ± 2 dB
1 7/8 ips: 50— 9.000 Hz ± 2 dB

Measured to DIN 45511:
7 1/2 ips: 40—22.000 Hz
3 3/4 ips: 40—18.000 Hz
1 7/8 ips: 40—10.000 Hz

Amplifier position: 50—18.000 Hz ± 3 dB

ERASE AND BIAS FREQUENCY: 85,5 kHz. Distortion less than 0,5 %.

INDICATORS: Moving coil meters. Optimum recording level: Deflection up to 0 dB at maximum 3 % distortion.

AMPLIFIER DISTORTION: Record Amplifier: Recording of a 400 Hz signal at 0 dB level, gives less than 0,5 % distortion from recording amplifier.

Playback Amplifier: 0,3 % distortion at 0, 75 V output voltage.

TAPE DISTORTION: A tape recorded with a 400 Hz signal at 0 dB level, gives less than 3 % tape distortion in playback.
A tape recorded with a 400 Hz signal 8 dB below 0 dB on indicator, gives less than 0,8 % tape distortion in playback.

WOW:

W. R. M. S.:
7½ ips — better than 0,07 %
3¾ ips — better than 0,14 %
1⅞ ips — better than 0,28 %

DIN 45511:
7½ ips — better than 0,1 %
3¾ ips — better than 0,2 %
1⅞ ips — better than 0,4 %

CROSSTALK ATTENUATION:

At 1000 Hz:
Mono > 60 dB Stereo > 50 dB

INPUTS:

Each channel has the following inputs:

1. Microphone input for dynamic low impedance microphone. Impedance: 200—700 ohm. Sensitivity at 400 Hz: 0,1 mV. Maximum input level: 25 mV. DIN socket. US-version, Telephone jack.
2. Line input for high impedance source. Impedance: 1 Mohm. Sensitivity at 400 Hz: 100 mV. Maximum input level: 20 V. Phono sockets, LINE INPUTS.
3. Line input for low impedance source. Impedance: 57 kohm. Sensitivity at 400 Hz: 5 mV. Maximum input level: 1 V. DIN socket RADIO: Pin 1, left channel: Pin 4, right channel. US-version: Phono sockets LOW IN.

OUTPUTS:

Emitter follower outputs, RADIO DIN socket pins 3 and 5. US-version: Phono sockets, OUTPUT LEFT and RIGHT.
Minimum load impedance: 100 ohm. Output level: A tape recorded with 400 Hz signal at 0 dB level, gives approx. 0,75 V in playback. HEADPHONES, stereo jack for connection of headphones.
Stereo jack is connected in parallel with RADIO socket pins 3 and 5. On US-version stereo jack is connected parallel with phono sockets OUTPUT LEFT and RIGHT.

SIGNAL TAPE/NOISE WEIGHTED (GERÄUSCHSPANNUNG):

Peak value measured according to DIN 45511 at tape speed 7½ ips and 5 % tape distortion:

4-track	2-track
54 dB	56 dB

SIGNAL TAPE/NOISE UNWEIGHTED (FREMDSPANNUNG):

Peak value measured according to DIN 45511 at tape speed 7½ ips and 5 % distortion:

4-track	2-track
51 dB	51 dB

SIGNAL/TAPE NOISE:

Measured linear R.M.S. at tape speed 7½ ips and 5 % distortion:

4-track	2-track
57 dB	57 dB

SIGNAL/TAPE NOISE: WEIGHTED (IEC A-CURVE) R. M. S.:

Measured at tape speed 7½ ips and 5 % distortion:

4-track	2-track
62 dB	64 dB

Note: At 3 % distortion all signal to noise ratio measurements (Signal/tape noise) are reduced by 2 dB.

DIMENSIONS:

Length: 15½" (39,4 cm), heigth: 6½" (16,5 cm) and depth: 12⅜" (31,6 cm).

WEIGHT:

20 lbs (9,1 kg).

2.0 MECHANICAL ADJUSTMENTS

2.1 Clutches

Control of Winding Torque

Note: All controls and measurements must be carried out with the tape recorder placed in horizontal position and with empty reels only. All controls are accomplished as shown in fig. 2.2 which presents two optimal modes of control. Take-up turntable is shown. By control of supply turntable, reverse the figure.

2.1.1 Take-up Turntable

Normal Forward Winding Torque
Set the operating lever to Normal Forward drive position with the motor running. The torque is read in table fig. 2.3, pos. 1. Ensure that the clearance between the polyurethane friction pads under the turntable and friction disc 991009 lays between 0,5—0,9 mm (0.02″—0.035″). If necessary, adjust screw A as shown in fig. 2.1.

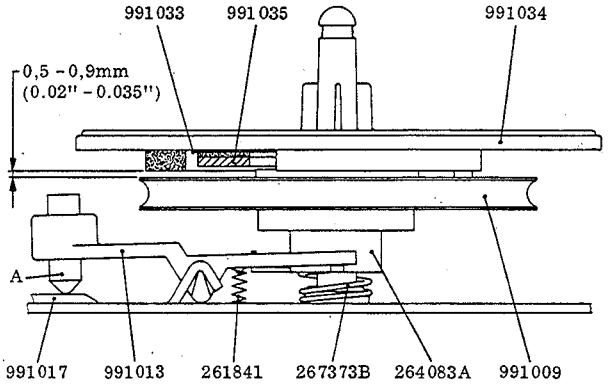


Fig. 2.1.

2.1.2 Take-up Turntable

Fast Forward Winding Torque
The torque is read in table fig. 2.3, pos. 3. If the torque deviates from the specifications in the table, check and, if necessary, alter the pressure of spring 263737B.
Ensure that there is a clearance between the studs on bushing 264083A and lever 991013. See fig. 2.4.

2.1.3 Supply Turntable

Tape Tension
The torque is read in table fig. 2.3, pos 2.

2.1.4 Supply Turntable

Fast Reverse Winding Torque
The torque is read in table fig. 2.3, pos. 3. If the torque deviates from the specifications in the table, check and, if necessary, alter the pressure of spring 261805A. See fig. 2.5.

The difference between Fast Winding Torque and Fast Reverse Winding Torque should be less than 130g (measured at 30 mm radius), or 50g (measured at 80 mm radius). If necessary, alter the pressure of spring 261805A (fig. 2.5), or spring 267373B (fig. 2.1).

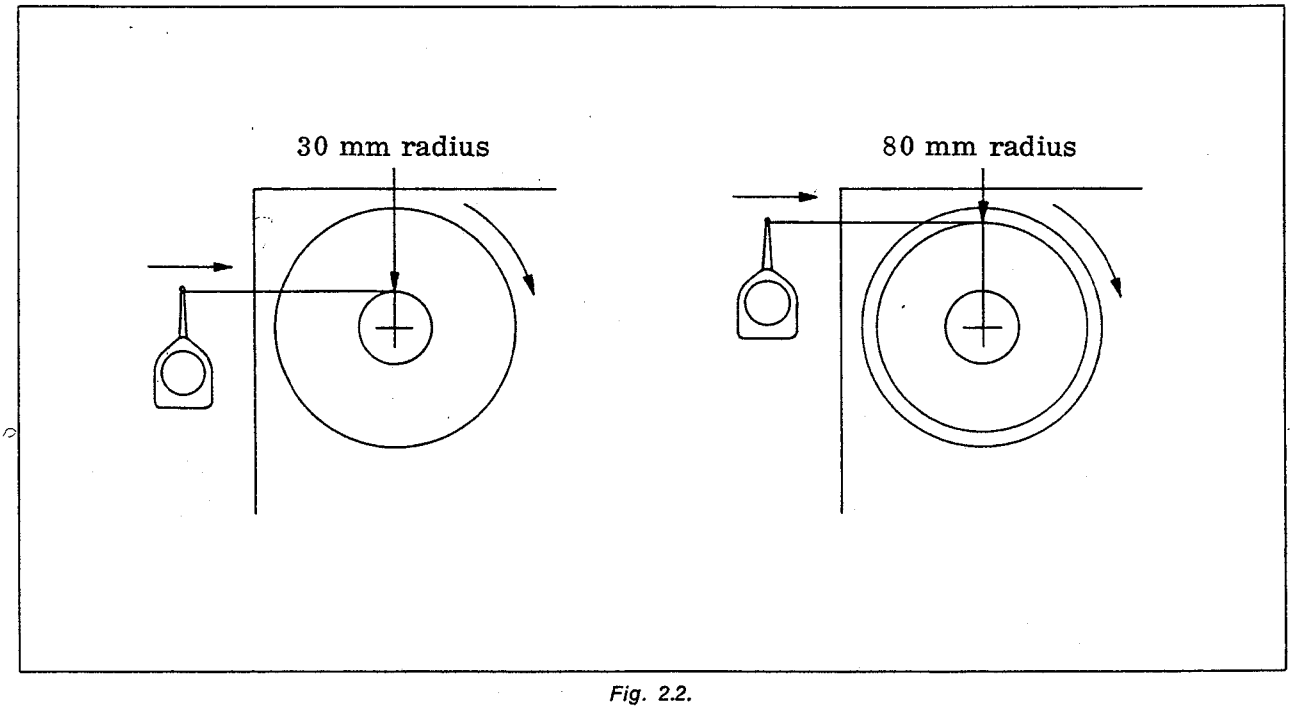


Fig. 2.2.

Table for Winding Torques

	Right/Left	Position of operating lever	Torque at 30 mm radius	Torque at 80 mm radius
inding	R	→	40g— 80g*	15g— 30g*
ape tension	L	→	0 — 22g	0 — 8g
ast winding	R	→→	240g—670g	90g—250g
	L	←←		

Fig. 2.3.

· a longer periode of continuous operation, an ease of the torque by 20—30 % is considered ormal.
ure that the torque is within the specifications ne table by running the tape recorder in verti- position, and with a full 7″ reel on take-up itable.

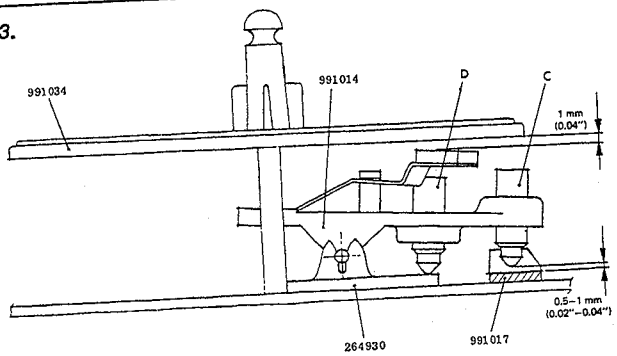


Fig. 2.6.

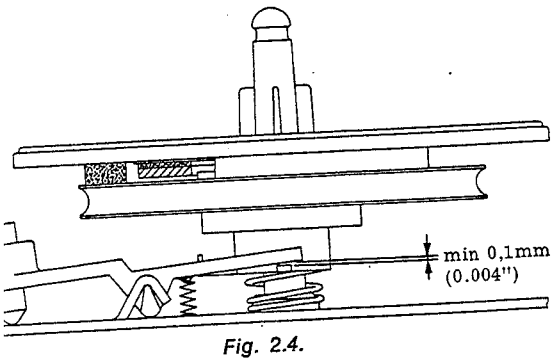


Fig. 2.4.

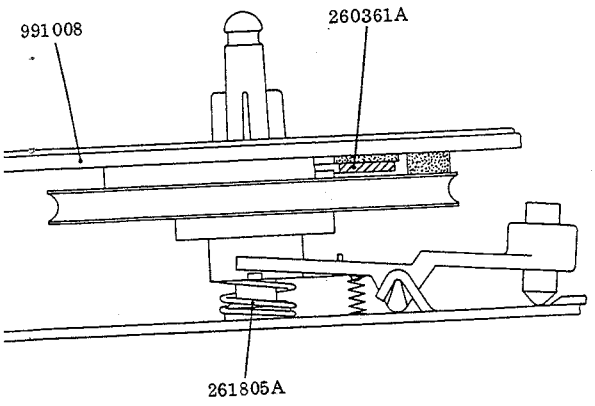


Fig. 2.5.

2.2 Brakes

See fig. 2.6

Set the operating lever to Normal Forward drive position. Check that the clearance between the brake pad and the turntable is approx 1 mm (0.04″). If necessary, adjust screw D.
Set the operating lever to Fast Forward Winding or Fast Reverse Winding position respectively. Ensure that the clearance between screw C and the bottom of the hinged delrin parts on operating arm 991017 lays between 0,5—1 mm (0.02″—0.04″). If necessary, adjust screw C.
The adjustment procedure is equal for both turntables.

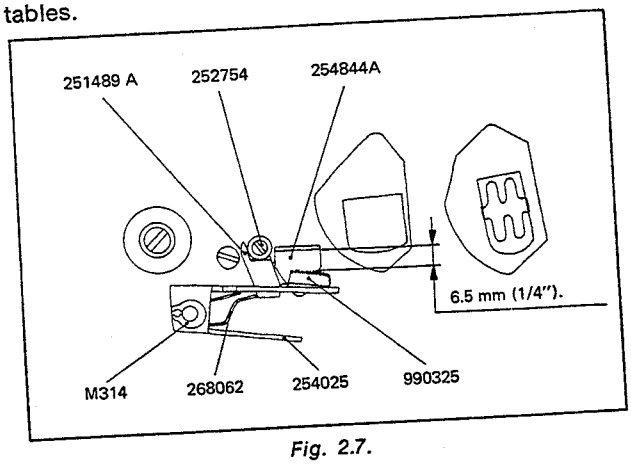


Fig. 2.7.

2.3 Pressure Pad Adjustment

Set the operating lever to Neutral position. The clearance between the pressure pad 990325 and the tape rest 254844A should be approx. 6,5 mm (1/4″) as shown in fig. 2.7. If necessary, adjust the clearance by bending the arm 254025 with a pair of pliers. See fig. 2.8.

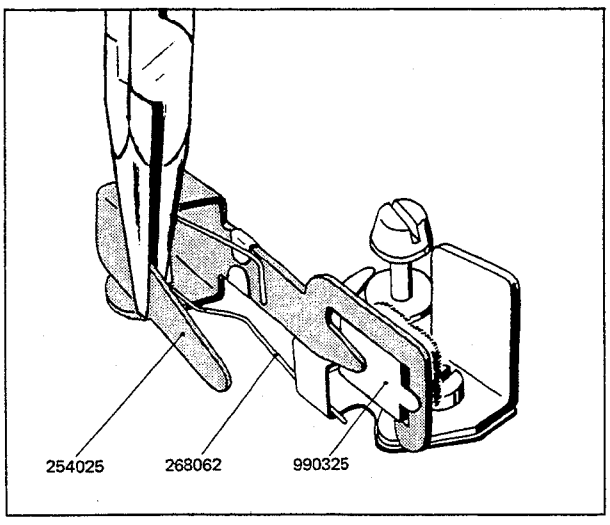


Fig. 2.8.

Set the operating lever to Normal Forward drive position. The pressure at the pad against the tape rest should be 80 g (2,8 oz) ± 10 %, measured on the end of the pressure pad arm 254025. See fig. 2.9. If necessary, adjust the pressure by bending the spring 268062 with a pair of pliers. See fig. 2.10.

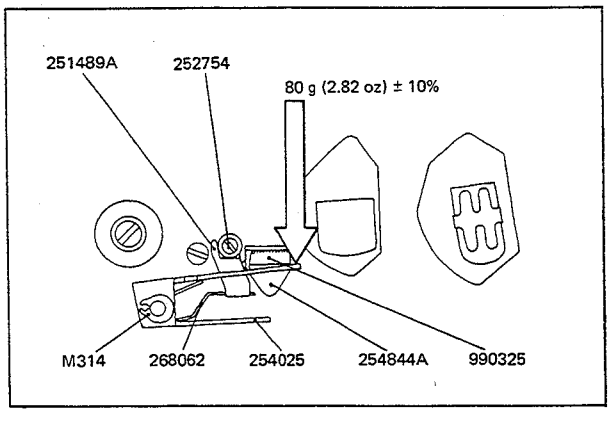


Fig. 2.9.

2.4 End Stop Mechanism

2.4.1 Tape Feeler Tension

The feeler tension against the tape should lay between 8 and 10 g (0.28–0.35 oz) in drive winding modes. Adjustment of the tension is accomplished by tightening or slackening the spring 243990. See fig. 2.12.

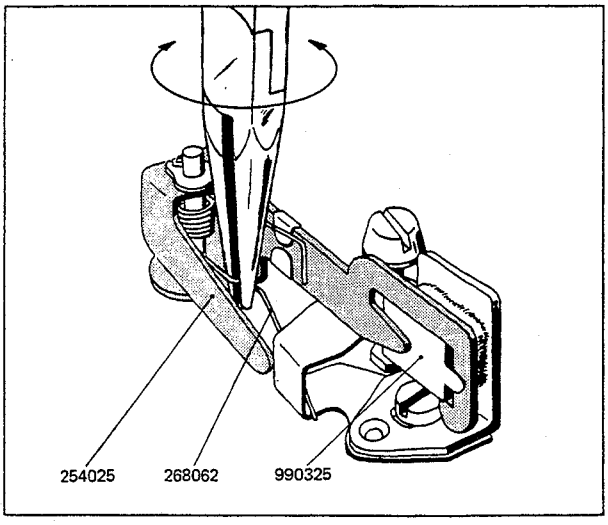


Fig. 2.10.

2.4.2 Adjustment of Tape Feeler

See fig. 2.11 and 2.12.
Set the operating lever to Normal Forward drive position. The mains switch is set to ON. No tape should be inserted. The tape feeler will therefore rest in the position where the motor is switched off. Push the feeler slowly through the guide post. When the rear side of the feeler is min. 0,5 mm (0.02″) from the polished tape contact surface of the guide post, loosen screw F, and move the microswitch slowly until the motor starts when the tape feeler is in the position specified above. Then tighten the screw.

When the tape feeler is released, the microswitch should open, and switch off the motor current when the space between the tape feeler and the arm 266741 is minimum 0,5 mm (0.02″). See fig. 2.12.
Check the switching on and-off positions of the tape feeler at both fast winding modes.

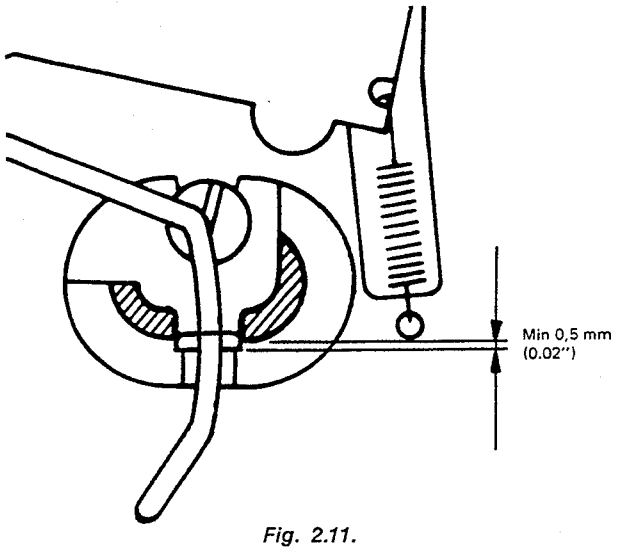


Fig. 2.11.

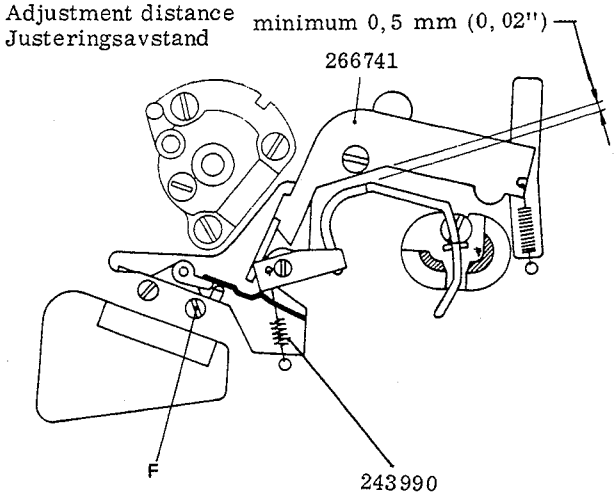


Fig. 2.12.

3.0 ALIGNMENT

It is important that the contact between the tape and the heads on the tape recorder is good. To obtain optimum results on new tapes (Low Noise), the tape should be run through the tape recorder approx. 5 times at normal speed to have the tape polished before measuring the frequency response and the signal-to-noise ratio.

3.1 Demagnetizing

Demagnetize the heads and adjacent parts before aligning the heads.
Move the demagnetizing coil slowly past the head gap at short distance. The head surface must on no account be touched, as scratches are detrimental to the performance. Hold the demagnetizing coil near the capstan for a few seconds.
Start the tape recorder and hold the demagnetizing coil right above the flywheel.

Note: Do not switch off the demagnetizer until it is at least 3 feet away from the tape recorder.

3.2 Bias- and Erase Circuits

3.2.1 Oscillator Frequency

Connect a calibrated long wave receiver (tuned to 256.5 kHz), frequency meter or frequency counter to the oscillator by means of a pick-up loop placed around the erase head. Adjust the oscillator frequency to 85.5 kHz by means of C 508.

3.2.2 Erase Voltage

Set the tape recorder for stereo recording and connect a VTVM to upper half of the erase head by means of a low-capacitance probe. The voltage should be 80–120 V. Then check that the same voltage appears across lower head-half.
Set the tape recorder for recording on channel L and check the voltage across upper half of the erase head. The deviation from the voltage measured in stereo recording should not exceed 10 V. Proceed similarly for recording on channel R.

3.2.3 Bias Current

Set the tape recorder for stereo recording and measure the voltage across upper half of the bias head by means of a VTVM. Adjust the voltage to 22 V by means of R 501. Check the voltage across lower head-half and adjust to 22 V by means of R 502. Demagnetize heads and tape path.

4.0 TAPE PATH

4.1 Visual Check

Load the recorder with a tape, and move the operating lever slowly to the normal forward drive position. Check that the bias head neither touches the height adjustment screws (C) on the record head base plate, nor presses the tape against the record head. Also check that the bias head is parallel to the record head.
Operate the start/stop knob, and check that the tape runs within the rims of the pressure wheel rubber without flickering on neither side of the pressure wheel. Check that height positioning of the guide posts is correct. It can be tolerated that the tape touches the flanges of the guide posts when the recorder is in normal forward drive, or as the drive mechanism is engaged. The tape must, however, by no means bulge at the flanges.

4.2 Mechanical Adjustment of Tape Path

Prior to the electrical adjustment of the heads, it is essential to make the tape run without sideways movement through the path.
Put a tape free from damages on the recorder in normal way and set the operating lever to normal forward drive position. Adjust the azimuth position of pressure roller 990334 with a screw driver as shown in fig. 4.2, until the tape is running evenly through the rest of the tape path, slightly touching one of the flanges of the guide post 1 located adjacent to the capstan.
Align guide posts 2, 3, and 4 similarly. If necessary, adjust pressure roller spring 234478 to make the tape run perfectly.

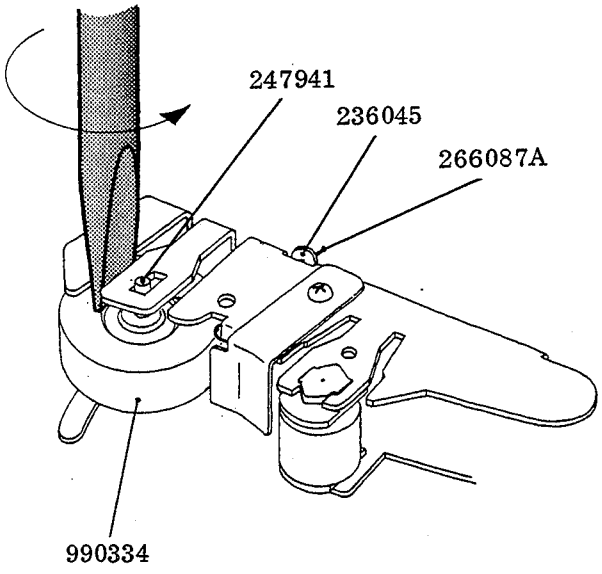


Fig. 4.2. Azimuth adjustment of pressure roller.

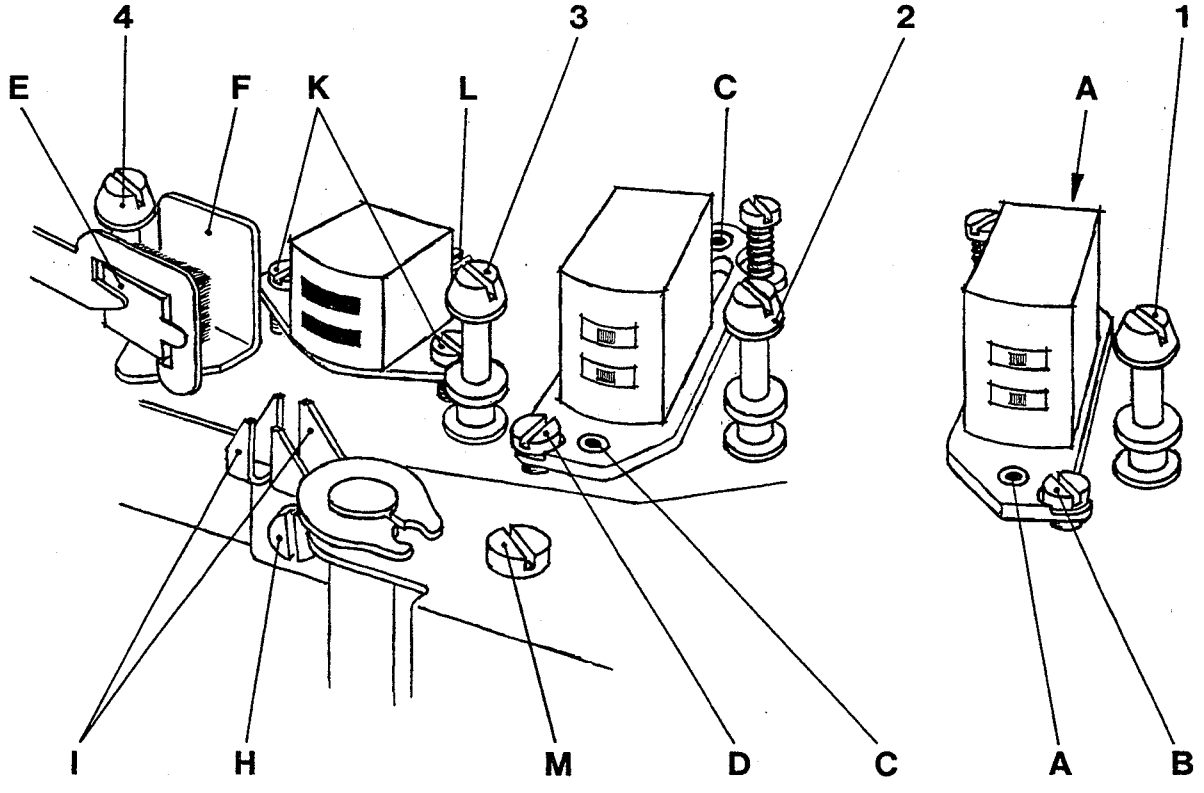


Fig. 4.1. Tape path adjustment screws.

5.0 HEAD ALIGNMENT WITH TANDBERG TEST TAPES, MODEL 3041X

5.1 Playback Head

Set the recorder for stereo playback and connect a VTVM to each one of the outputs. Output selector to position STEREO.

5.1.1 Height Adjustment

Play Tandberg test tape No. 1. This is a full track prerecorded tape with 1.000 Hz recorded at 7½ ips, and with area corresponding to track 3 reduced by approx. 30 dB. Adjust the height of the playback head by means of the screws (A) until minimum output is obtained from track 3 (channel R), while endeavouring to maintain the headfront parallel to the tape.

5.1.2 Azimuth Adjustment

Play Tandberg test tape No. 2. This is a full track prerecorded tape with 10.000 or 15.000 Hz recorded at 7½ ips. Adjust the azimuth position of the playback head by means of the screw (B), until maximum indication on the VTVM is obtained.

5.2 Record Head

5.2.1 Height Adjustment by Visual Inspection

Insert a new tape, and start the recorder in normal forward drive. Check visually that the tape appears to run parallel with the upper track of the record head, with a play of approx. 0.1 mm (4 mils). If necessary, adjust the height with screws (C) fig. 4.1, while endeavouring to maintain the headfront parallel to the tape.

5.2.2 Height Adjustment by Track Measurement

Record in stereo, well above normal level, first in one direction, then in the opposite. Cut off a length of tape and dip it into a solution of fine grained iron oxyde powder and alcohol (Magna See). The tracks will then by visible as four dark stripes with spacings in lighter shade. Fig. 7.1 shows the correct pattern on the tape and the patterns obtained when the head is positioned either too high or too low.
Adjust as above and perform a new track measurement.

5.2.3 Azimuth Adjustment

Load a new tape into the tape recorder and record at tape speed 7½ ips a 15.000 Hz signal in stereo. Set OUTPUT selector to position STEREO. Adjust both RECORD LEVEL knobs for approx. 150 mV at the output. Adjust the record head azimuth screw (D) for maximum output from both channels simultaneously, or best compromize.

5.3 Bias Head

5.3.1. Vertical Adjustment

Move the operating lever slowly to the normal forward drive position and check that the head fronts of bias- and record heads are parallel. If necessary, bend the arm of the bias head as required.

5.3.2 Height Adjustment

Set the tape recorder in stereo record mode, and unscrew the locking screw (H) fig. 4.1, about ½ turn. Connect a VTVM across each one of the record head halves. Move the bias head up or down by means of adjustment screw (M) for the highest possible reading on the voltmeter. Check that the tape runs freely in the groove in front of the bias head and that there is sufficient clearance between the bias head and the mounting plate for the record head. The height position of the bias head is not critical, and if the clearance between the bias head and the mounting plate for the record head is insufficient, raise the bias head slightly.

5.3.3 Horizontal Adjustment

Connect a VTVM across each one of the record head-halves, and set the tape recorder for stereo recording. Insert a screwdriver in groove I, ref. fig. 4.1, and pull the bias head to the right.
Then pull the bias head carefully by means of the screwdriver towards the left hand side. Induced voltage (bias) in recording head increases to a maximum. Continue pulling the head towards left side until the bias is reduced by 10—15 % below maximum. When the position has been found, tighten the screw (H) while maintaining correct horizontal position of the head. Then recheck the output voltage. If a noticeable change has occured, the horizontal procedure has to be repeated.

5.4 Erase Head

5.4.1 Height Adjustment

By visual inspection, check that approx. 0.25 mm (10 mils) of the upper half of the erase head is visible above the tape. Insert Tandberg test tape No. 9 and record a 400 Hz signal at 7½ ips well above normal level on channel R (track 3). Dip the tape in a solution of fine grained iron oxyde powder and alcohol (Magna See solution). Check that the recorded track is positioned in centre of the erased track. Make sure that no parts of the adjacent tracks are erased, see fig. 7.2. If necessary, adjust the height of the erase head by means of the screws (K) and (L) ref. fig. 4.1, and repeat the above check.

5.4.2 Azimuth Adjustment

Check that the head front of the erase head is perpendicular to the mounting plate. If necessary, adjust azimuth position by means of the screws (K) ref. fig. 4.1. This adjustment is not critical.

5.5 Model 3021X

The alignments specified in para. 5.0 are valid for the model 3021X with the exception of paragraph 5.1.1, which is superseded by 6.1.1 and paragraph 5.2.1, which is superseded by 7.2.2.

6.0 HEAD ALIGNMENT WITHOUT TANDBERG TEST TAPES, MODEL 3041X

6.1 Playback Head

6.1.1 Height Alignment

The height of the playback head is aligned by the height adjustment screws (A), ref. fig. 4.1. The upper edge of the tape shall run flush with the upper part of the head lamination for channel L.

6.1.2 Azimuth Alignment

Set OUTPUT selector to position STEREO.
Play back a standard azimuth alignment tape with a VTVM connected to each output. Adjust the position of the playback head by the azimuth adjustment screw (B) ref. fig. 4.1, until maximum reading is obtained on the output meters.

6.2 Record Head

Follow the instructions given under paragraph 5.2.

6.3 Bias Head

Follow the instructions given under paragraph 5.3.

6.4 Erase Head

6.4.1 Height Adjustment

The height of the erase head is aligned by the height adjustment screws (K and L) ref. fig. 4.1. Approx. 0.25 mm (10 mils) of the ferrite core for the upper track of the erase head should be visible above the tape.

6.4.2 Azimuth Adjustment

Align the azimuth position of the erase head by the azimuth adjustment screws (K). The erase head should be parallel with the mounting plate for the heads. The azimuth position of the erase head is not critical.

6.5 Model 3021X

The alignments specified in paragraph 6.0 are valid for model 3021X with the exception of paragraph 6.2 which is superseded by 5.2. Paragraph 5.2.1 is superseded by 7.2.2. Paragraph 6.4.1 is superseded by 7.2.1.

7.0 TRACK CONTROL

7.1 Model 3041X

7.1.1 Record Head

Record a 1.000 Hz signal from a generator well above optimum recording level in stereo. Record on tracks 1 and 3 for approx. 5 seconds. Turn the tape and make a similar recording on tracks 4 and 2. Cut the tape and dip it into a mixture of fine grained iron oxyde powder and alcohol (Magna See solution) to make the recording visible. The spaces between the recorded tracks should be distributed equidistant across the tape, ref. fig. 7.1. Readjust the height position, if necessary, and recheck the azimuth alignment.

7.1.2 Erase Head

Insert a full-track prerecorded tape and record a 1.000 Hz signal from a generator, well above optimum recording level in mono on track 3 (channel R). Cut the tape and dip it into the Magna See solution. Check that the prerecorded track is in the centre of the erased area, ref. fig. 7.2. Adjust the vertical position of the erase head if necessary.

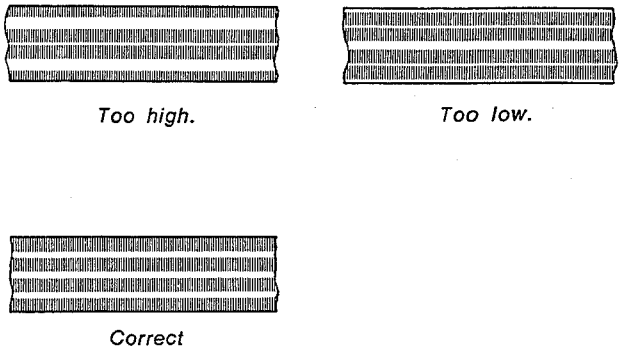


Fig. 7.1. Track measurement of record head.

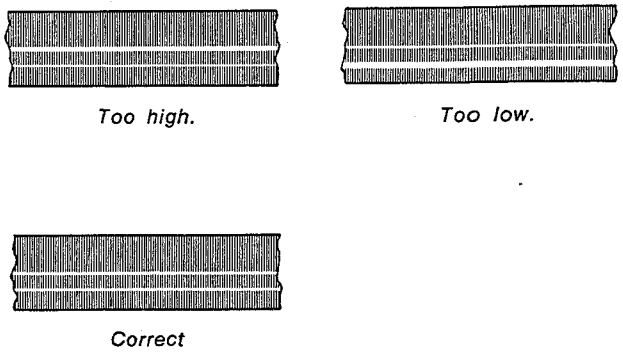


Fig. 7.2. Track measurement of erase head.

7.1.3 Playback Head

Record a 1.000 Hz signal on track 1 (channel L) and a 500 Hz signal on track 3 (channel R) well above optimum recording levels. Set OUTPUT selector to position STEREO. Turn the tape around and play back track 2 (channel R). No signal should be heard. Raise the playback head if the 1.000 Hz signal is heard. Lower the playback head if the 500 Hz signal is heard. Recheck the azimuth position.

7.2 Model 3021X

7.2.1 Erase Head

The height of the erase head is aligned by the adjustment screws (K and L) ref. fig. 4.1. Record a 1.000 Hz signal in stereo well above optimum recording level on a full-track prerecorded tape. Dip the tape in the Magna See solution and check that the tracks are distributed symmetrically across the tape. Readjust the erase and the record heads, if necessary.

7.2.2 Record Head

The height of the record head is aligned by the height adjustment screws (C). Record a 1.000 Hz signal in stereo well above optimum recording level on a full-track prerecorded tape. Dip the tape in Magna See solution and check that the tracks are distributed symmetrically across the tape. Readjust the erase and the record heads, if necessary.

7.2.3 Playback Head

The height of the playback head is aligned by the height adjustment screws (A). The tape shall run parallel with the upper edge of the lamination for channel L. Readjust the azimuth position if necessary.

8.0 ADJUSTMENT AND CONTROL OF THE AMPLIFIERS

8.1.1 Playback Level Adjustment

Connect a VTVM to each one of the outputs, and set OUTPUT selector to position STEREO. Set the recorder for 7½ ips playback of Tandberg test tape No. 4 and adjust R451 (L) and R351 (R) for 0.7 V reading on both vacuum tube voltmeters.

8.1.2 Adjustment of Bias Current

Insert a new reel of good quality tape (Low Noise). Connect a VTVM to Output terminals, and signal generator to HIGH Input terminals and set the generator for 1.000 Hz and 0.5 volt. Set output selector to STEREO. Set the tape recorder for stereo recording. Adjust the Record Level Control to 75 mV deflection on VTVM. Adjust R501 to maximum deflection on left channel VTVM, and R502 to maximum on right channel VTVM.

Note: The 2-track model is also equipped with individually tuned bias- and erase heads. The values of C502, C503, C515 and C516 are labelled on the bias- and erase heads respectively. The capacitances are given in pF. Upper number refers to upper track.

8.1.3 Record/Playback Level Adjustment

Connect a VTVM to each one of the outputs. Insert a new tape and record a 400 Hz signal from a generator at 7½ ips in A-test. OUTPUT selector to position SOURCE. Adjust the input levels for a VTVM indication of 0,7 volt at both outputs. Adjust R433 for a 0 dB reading on left record level indicator and R333 for the same reading on right indicator. Set OUTPUT selector to position STEREO and adjust R451 (L) and R351 (R) to 0,7 V indication on VTVM.

8.1.4 Record/Playback Curves

Ref. paragraph 9.0 for control of record/playback curves.

8.1.5 Distortion

Connect signal generator, 400 Hz 0.5 V, to High Input and distortion meter to outputs. Record in B-test on both channels. OUTPUT selector to position STEREO. Set the tape recorder for stereo recording. Adjust Record Level controls to 0 dB deflection on indicators. Check distortion to be less than 3 %. If distortion exceeds 3 % readjust recording level and indicator, ref. paragraph 8.1.3.

8.1.6 Control of Playback Amplifier

Connect a VTVM to each one of the outputs. OUTPUT selector to position STEREO.
Play back Tandberg test No. 3. This is a full track prerecorded tape with the following frequencies: 250–10.000–5.000–1.000–100–50–250 Hz recorded at 7½ ips tape speed. The tape conforms with the N. A. B. standard. The output tolerances are: 10 kHz: 0 — + 4 dB, 5 kHz ÷ 1 — + 3 dB. The other frequencies have tolerances ± 2 dB. The difference in level between the two channels should be less than 3 dB.

8.2 Tape Speed Control

8.2.1 Using Frequency Meter or Counter

Set OUTPUT selector to position L.
Connect a frequency meter or counter to Output L and play back Tandberg test tape No. 11 (1.000 Hz) at 7½ ips tape speed. Difference from correct tape speed is indicated in %. Tolerance: ± 1,5 %.

8.2.2 Using Transformer and Vacuum Tube Voltmeter

Connect a transformer 115/0.5 V or 230/0.5 V, 50/60 Hz and a VTVM to Output and the mains as shown in fig. 8.1, dotted line indicates phono socket on US-version. Set OUTPUT selector to position L. Play back Tandberg test tape No. 10 a (mains frequency 50 Hz) or No. 19 a (mains frequency 60 Hz) at 7½ ips tape speed.
Deviation from correct tape speed will give a beat across the VTVM.
Clock the time for 10 complete excursions of the meter needle.
Read the speed deviation in per cent corresponding to this particular time from the nomogram in fig. 8.2.
Brake left hand turntable slightly to decide if tape speed is too high or too low. Increased deviation indicates too low tape speed.
At 3¾ ips, play Tandberg test tape No. 10 b (50 Hz mains frequency). Proceed as for 7½ ips to find speed accuracy.
Speed tolerance: ± 1,5 %.

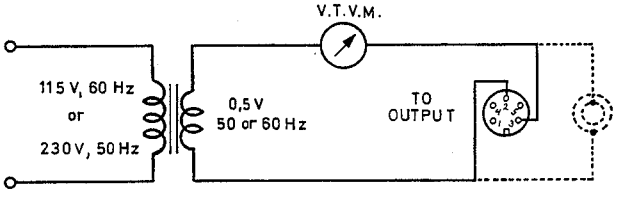


Fig. 8.1.

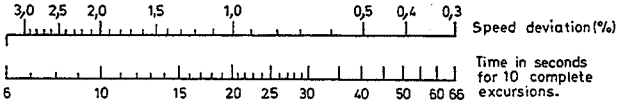


Fig. 8.2.

8.2.3 Using Tape of Known Length

Insert a tape of known length 450" (1144 cm) and play it back. Time taken for the whole length should be:

7½ ips: 60 seconds
3¾ ips: 120 seconds
1⅞ ips: 240 seconds

Tolerance for all tape speeds: ± 1,5 %.

9.0 RECORD/PLAYBACK CURVES

Connect a VTVM to each one of the outputs L and R. In order to avoid interference from the oscillator voltage, a band stop or a low pass filter tuned to 85.5 kHz must be inserted between the outputs and the voltmeters.
Set the tape recorder for stereo recording at 3¾ ips in B-test (STEREO) and record on Low Noise Tape a 400 Hz signal at a recording level 30 dB below optimum (0 dB). Use the output VTVM readings as reference levels.
Then record a 16.000 Hz signal at the same level and check that the output voltage is within ± 2 dB. Perform fine adjustment of record head azimuth position. If the voltage is too high, increase bias current by means of R501 for channel L and R502 for channel R.
If the voltage is too low, alter the input signal frequency to 1.000 Hz and adjust for maximum output voltage by means of R501 and R502 for channels L and R respectively. Then go back to 400 Hz, establish the reference level, and recheck the output level at 16.000 Hz. When the tolerance at 16.000 Hz has been met, check that the output level at frequencies between 50 and 16.000 Hz do not deviate more than ± 2 dB from reference level.
Perform the same check for 7½ ips at frequencies between 40 and 20.000 Hz, and then finally check for 1⅞ ips between 50 and 9.000 Hz. Ref. level 400 Hz.
The output levels of the two channels should not at any frequency differ by more than 3 dB.

9.1 Readjustment of Record/Playback level

For readjustments of Record/Playback level ref. paragraph 8.1.3.

9.2 Distortion

Ref. paragraph 8.1.5 for adjustment and control of distortion.

9.3 Control of Playback and Record Amplifiers

If the specified tolerances for frequency response are exceeded, check the playback and record amplifiers.

9.3.1 Playback Amplifier

Insert a 22 ohm resistor in series with playback head and junction 52 (59).
Connect a signal generator in series with a 1 kohm resistor and a 100 μF capacitor and playback head, see fig. 9.1.
Connect also VTVM to each of the outputs and set output selector to position STEREO. To ensure correct signal response, apply oscilloscope. Tune the generator to 400 Hz and adjust the level 20 dB below 0.75 V, i.e. 75 mV. Check the frequency response according to fig. 9.2.

9.3.2 Record Amplifier

Connect a VTVM to a 100 ohm resistor in series with the record head and ground as shown in fig. 9.3 and a signal generator to HIGH Input for each channel. Shortcircuit trimming capacitor C508 in oscillator. Set the tape recorder for stereo recording. Set the level 30 dB below 0 dB indicator deflection i.e. 10 dB down by means of Record Level Controls, 20 dB down on signal generator, and use 400 Hz as reference on VTVM deflection. Check the frequency response according to fig. 9.4. Remove shortcircuit of C508.

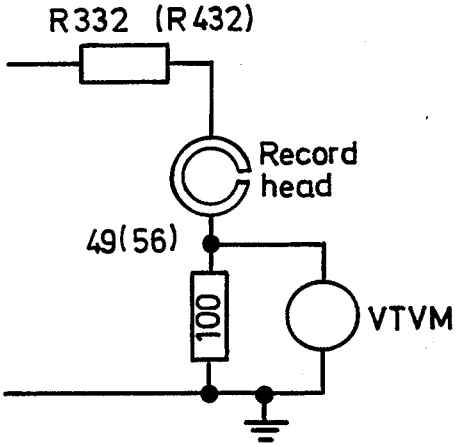


Fig. 9.3.

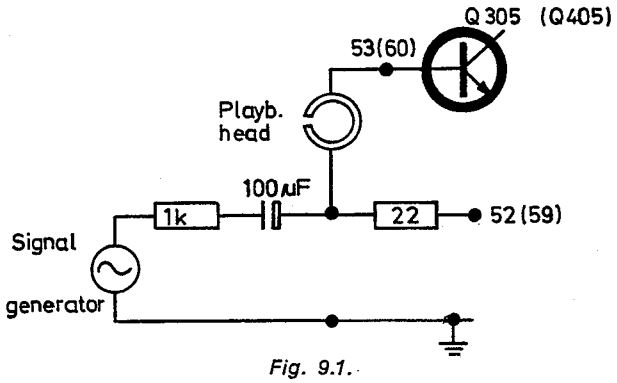
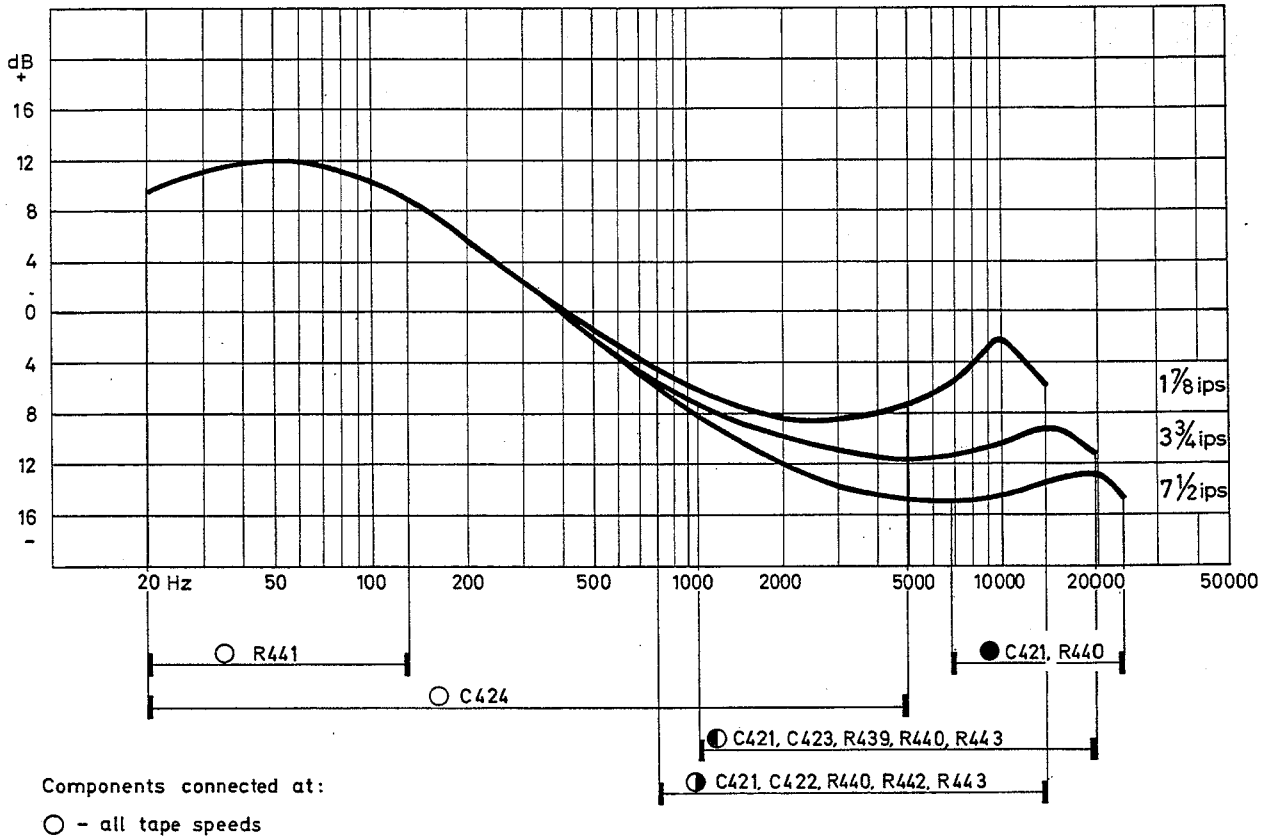


Fig. 9.1.



Components connected at:

- ○ - all tape speeds
- ● - 7 1/2 ips
- ◐ - 3 3/4 ips
- ◑ - 1 7/8 ips

Fig. 9.2. Playback curves.

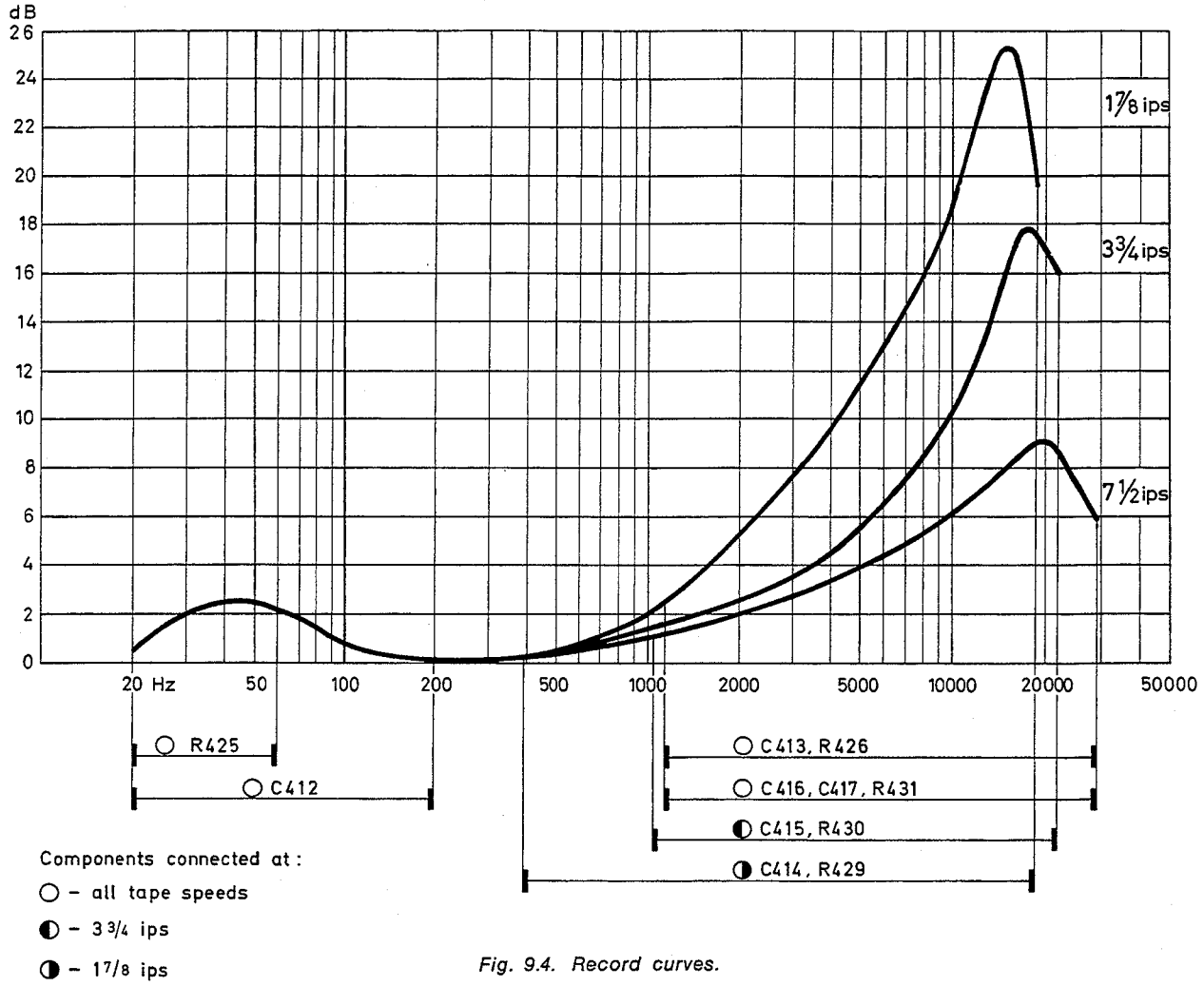


Fig. 9.4. Record curves.

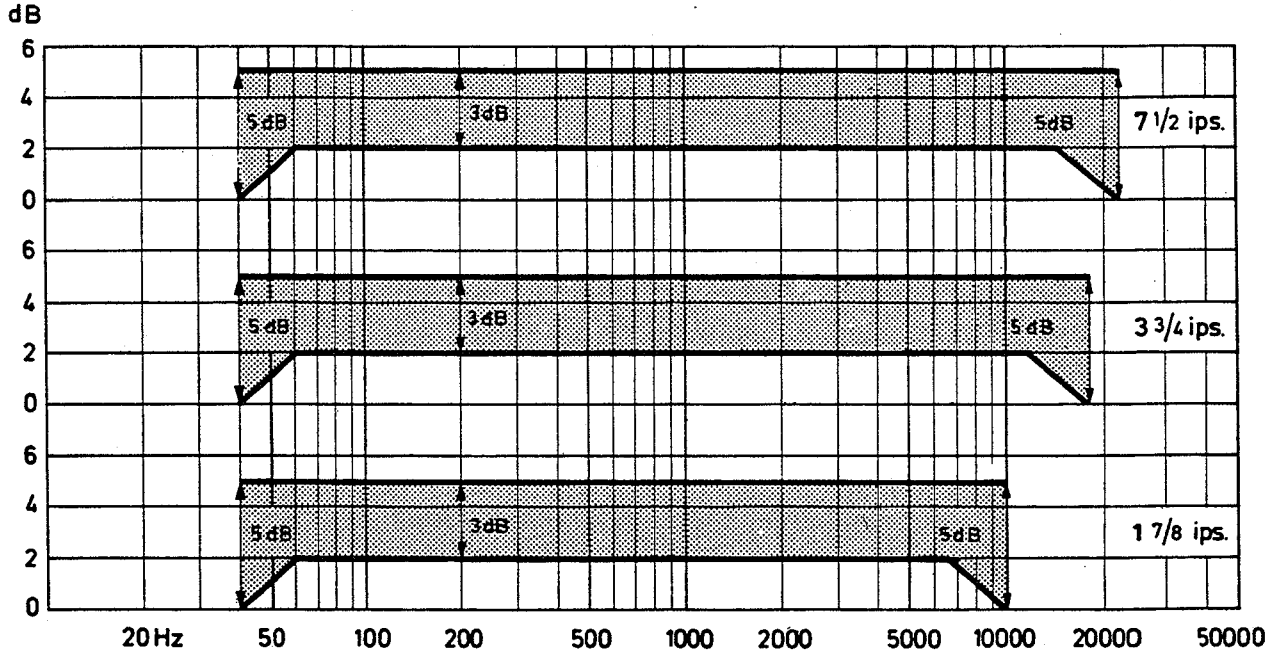


Fig. 9.5 Total frequency response tolerances according to DIN 45511.

10.0 MODIFICATIONS

10.1 Modification from 115/130/230/240 V, 50/60 Hz Operation

The transformer and motor must be rewired according to figures below when changing from 115/130/230/240 V operation.
When modifying from 50 to 60 Hz or vice versa, the motor pulley has to be changed.

Motor pulley:

50 Hz operation, part number: 243940C
60 Hz operation, part number: 248351B
When ordering motor pulley, specify part number.

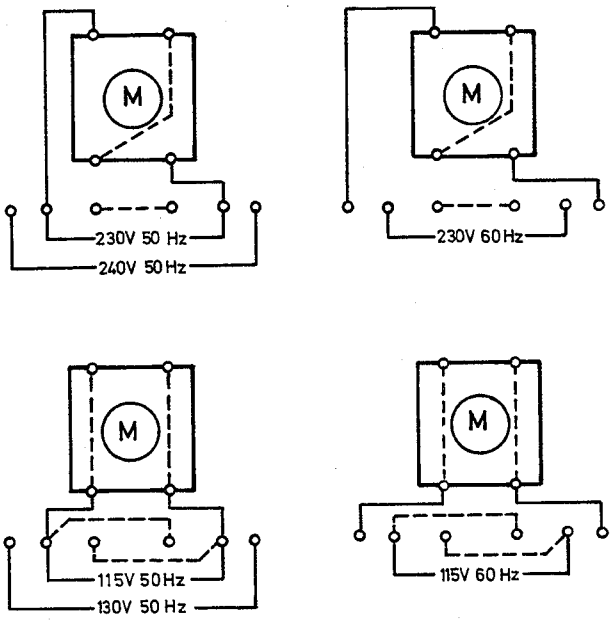


Fig. 10.1. Motor and transformer connections.

10.2 Modification from Four-Track to Two-Track Version

The following components have to be changed when modifying from four-track to two-track.
Value of total capacitance is labelled on two-track heads.

Part	Four-track	Two-track
Record Head	C04-11R*	F82-07R
Record Head	F53-11R**	F82-07R
Playback Head	C03-10P	F83-11P
Erase Head	D84-18E*	D87-20E
Erase Head	G51-18E**	D87-20E
Bias Head	D90-03B	D92-04B
R432	5,6kohm	2,7kohm
R332	5,6kohm	2,7kohm
C515	250pF	Add capacitance
C516	250pF	until labelled
C502	3300pF	capacitance
C503	3300pF	is obtained

* Valid on models below serial No. 2733300
** Valid on models above serial No. 2733300

10.3 Component Modification in Series 3000X

- Transistor Q503 is changed from type BC147B to BC107B. Resistor R505 is changed from 2,2 kohm to 1 kohm. Both modifications are introduced from serial number 2741500.
- R116 and R216 are changed from 1 kohm to 220 ohm. C109 and C209 are changed from 6800 pF to 0,022 μF. Both modifications are introduced from serial number 2744100.

11.0 LUBRICATION

The Motor:

The motor should be lubricated after approximately every 3000 hours of use.
The upper and the lower bearing should be lubricated with a Teresso oil 43 or 47 from Esso.

The Self Lubricating Bearings:

The turntables, the flywheel and the speed transfer-wheel are mounted in self lubricating bearings and should usually not be lubricated. If, however, it should be necessary to lubricate the bearings for any reason, use Teresso oil 43 or 47 from Esso.

Note: Utmost care must be taken while lubricating. Use only one fractional drop of oil for each bearing. Excessive oil might seriously affect the friction drive.

12.0 ILLUSTRATIONS WITH REFERENCE PART NUMBERS

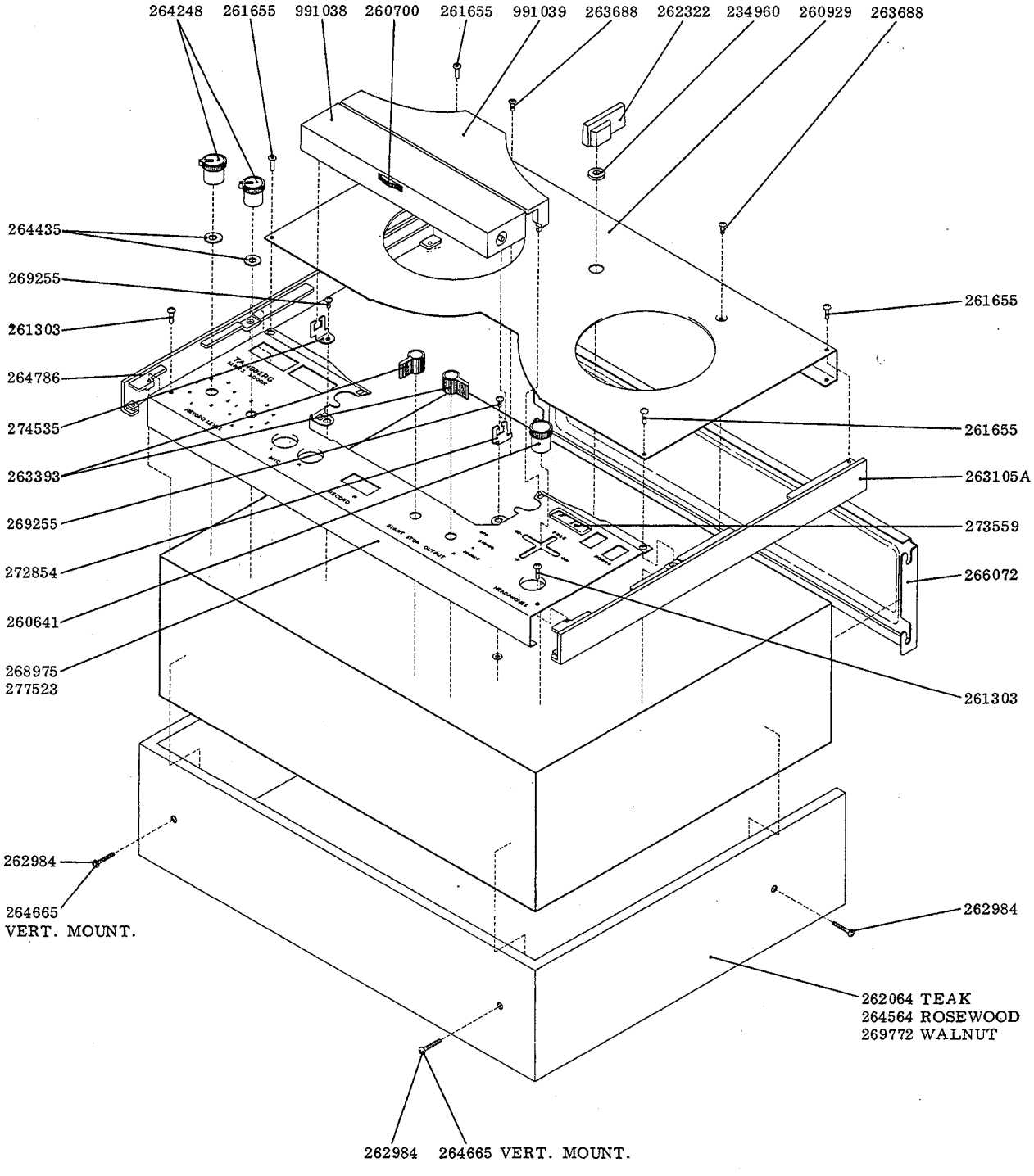


Fig. 12.1

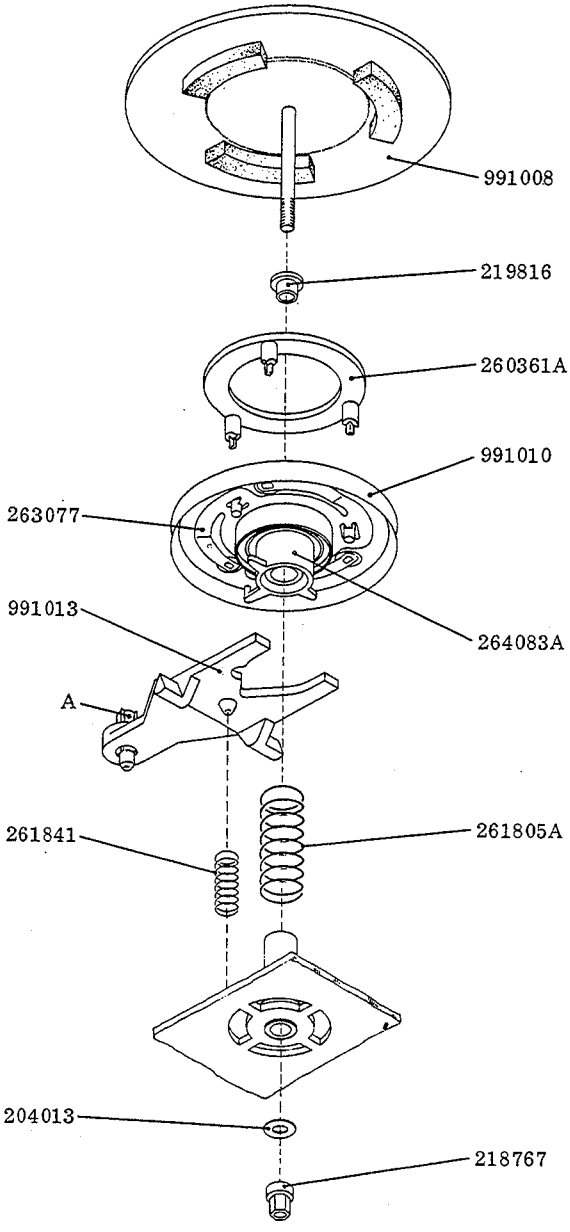


Fig. 12.2. Supply turntable.

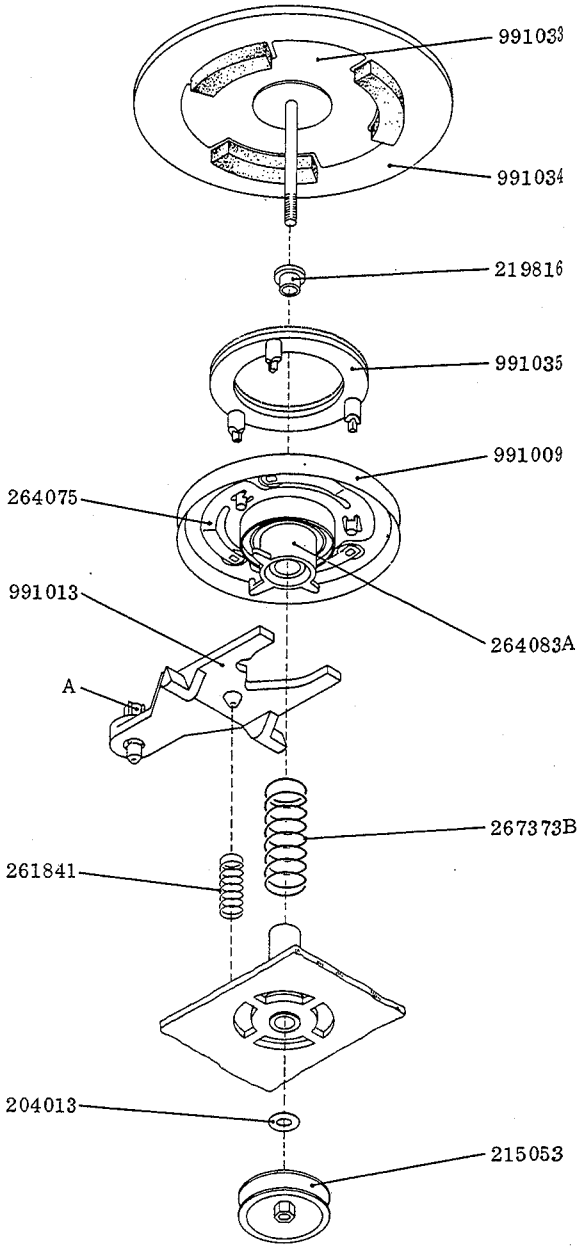


Fig. 12.3. Take up turntable.

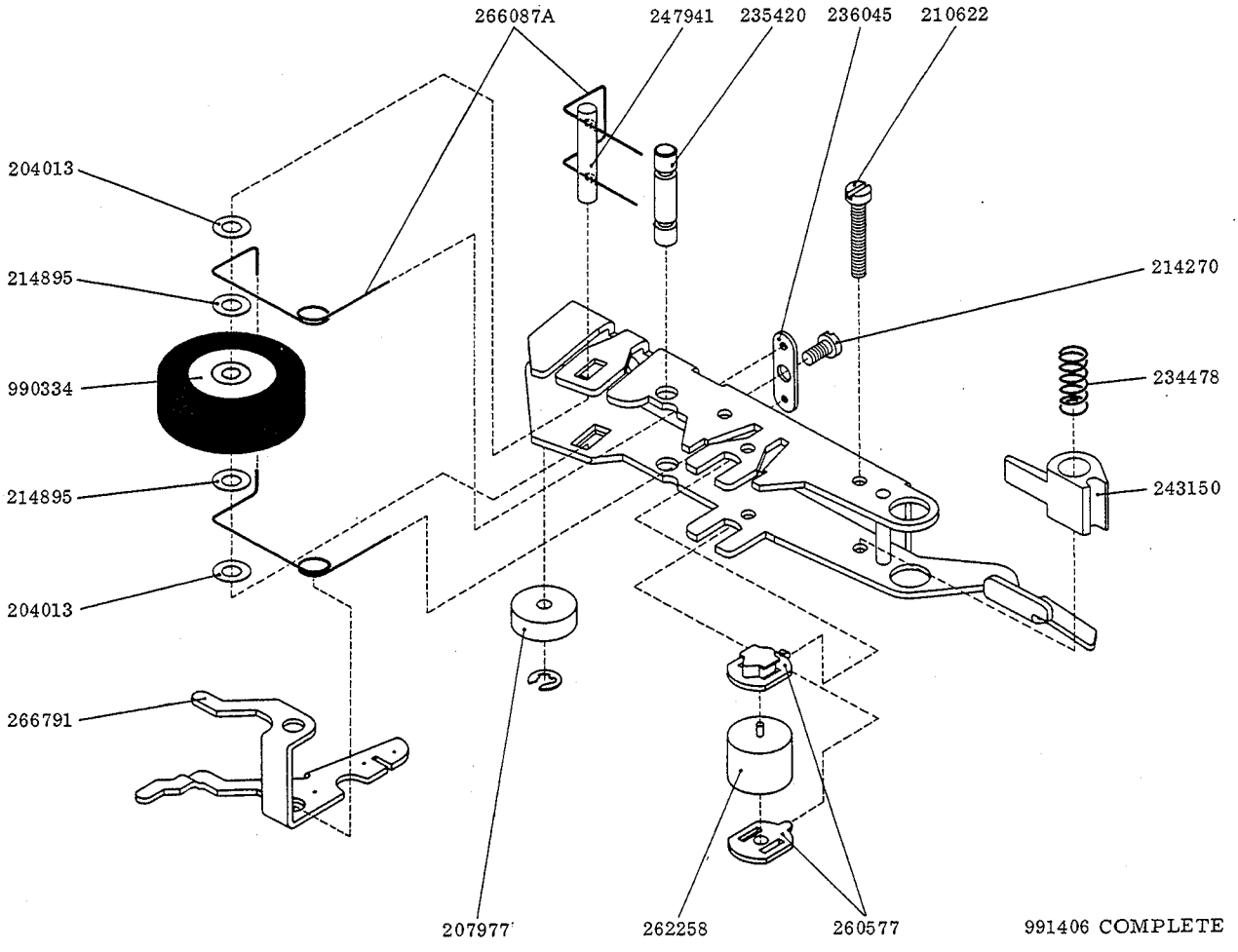


Fig. 12.4. Pressure roller arm, assembly.

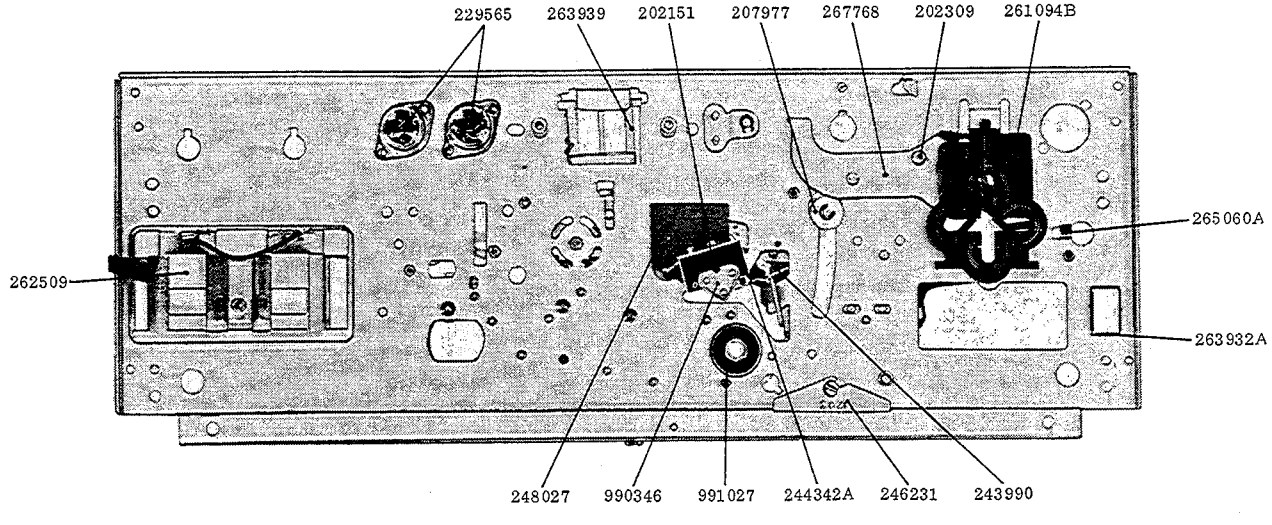


Fig. 12.5. Upper mounting plate seen from underneath.

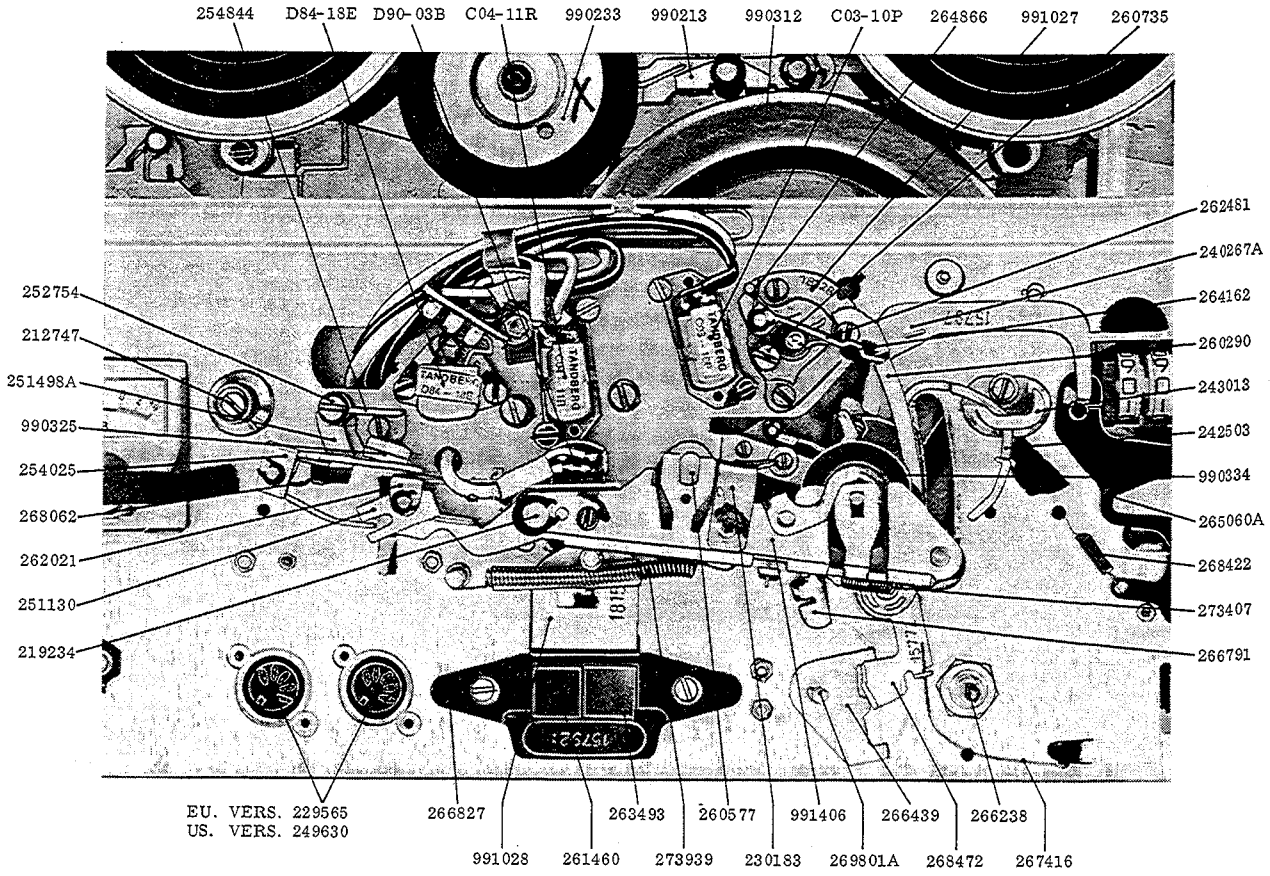


Fig. 12.6. Tape path and pressure roller arm.

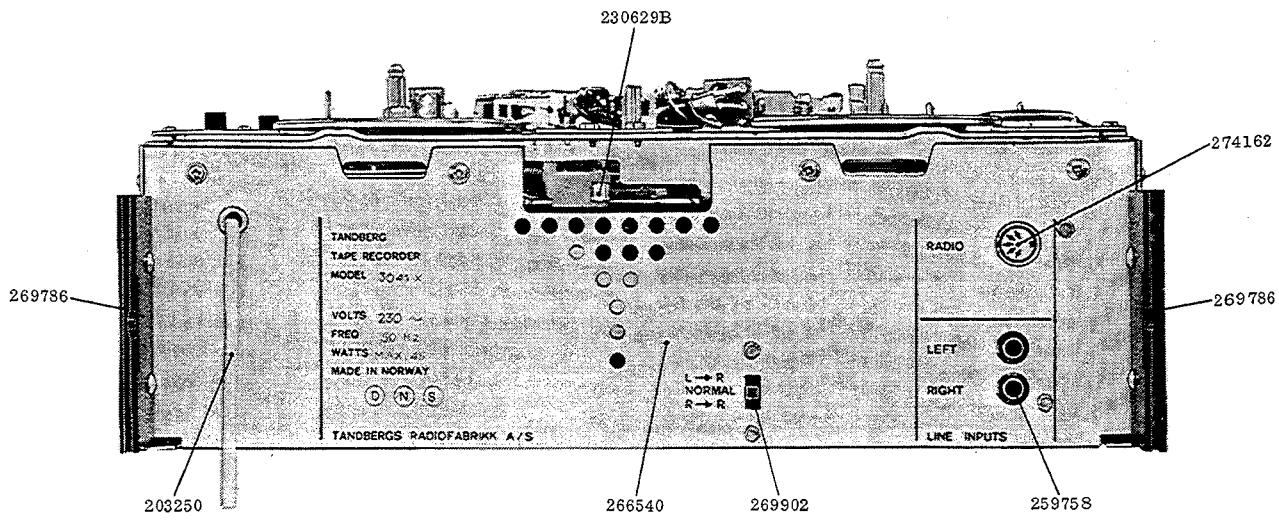


Fig. 12.7. Rear view. European version.

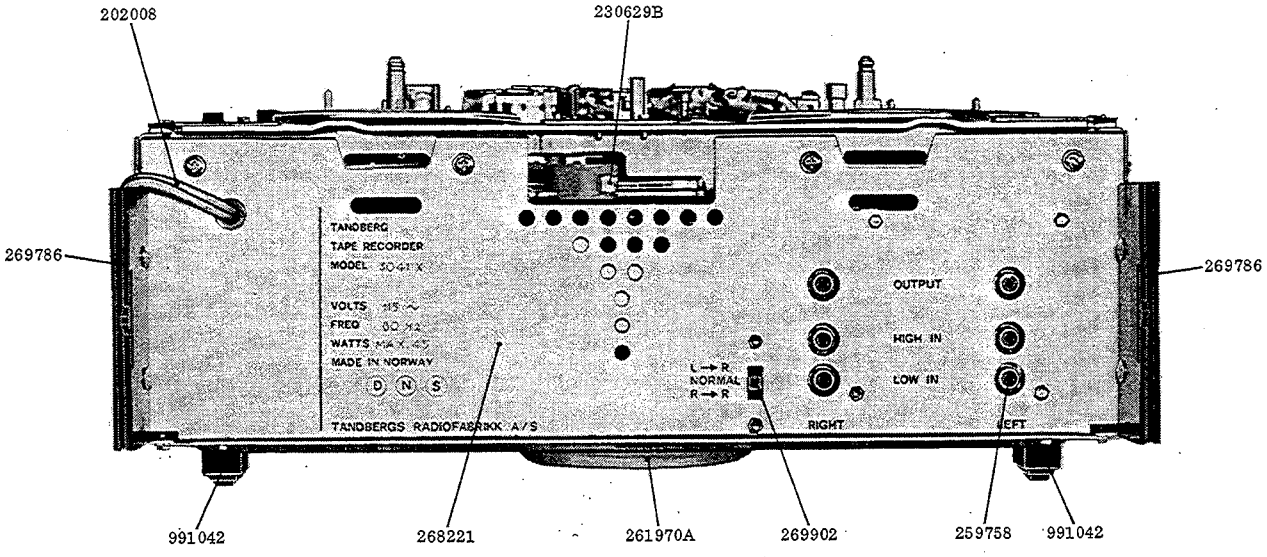


Fig. 12.8. Rear view. U.S. version.

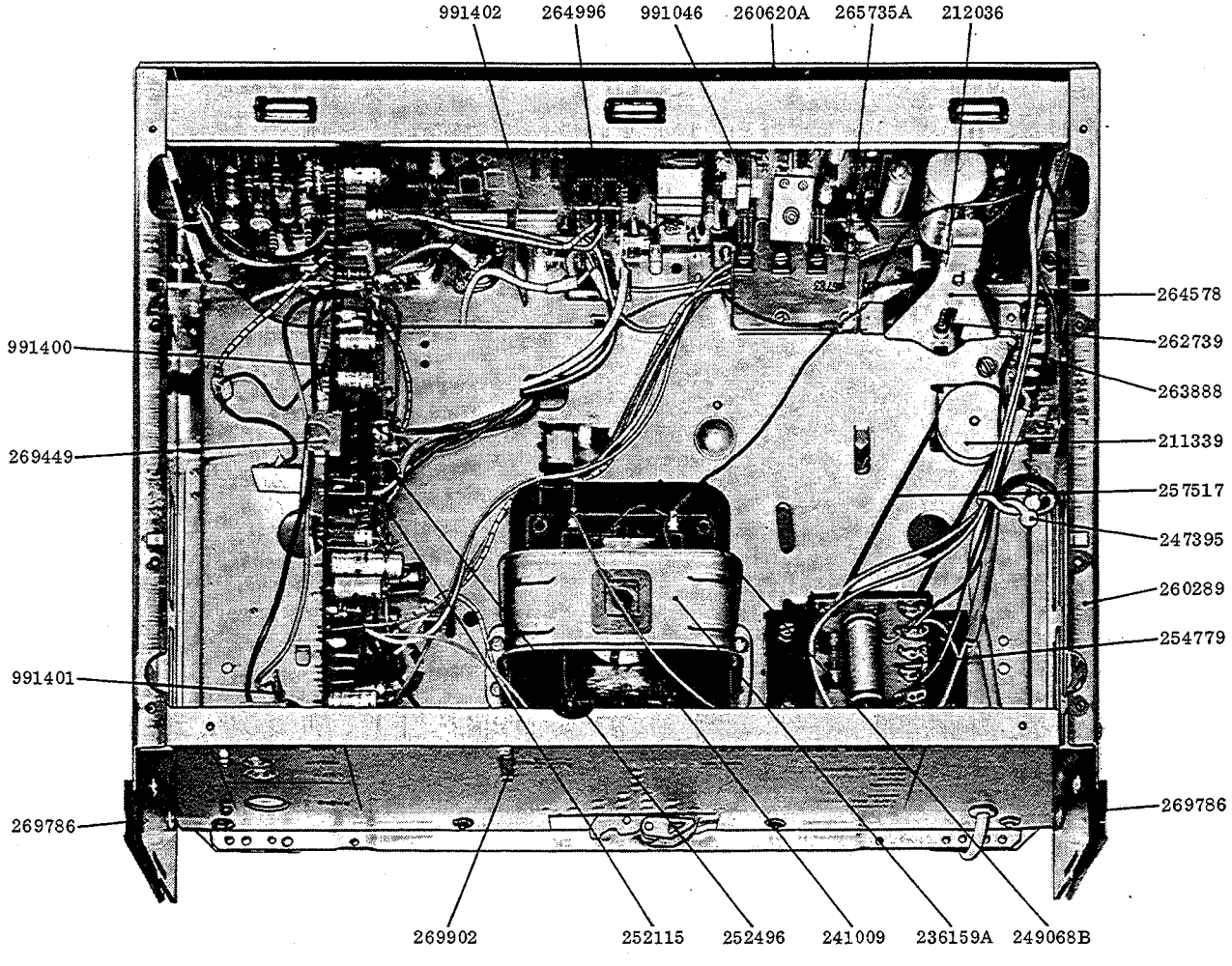


Fig. 12.9. Bottom view.

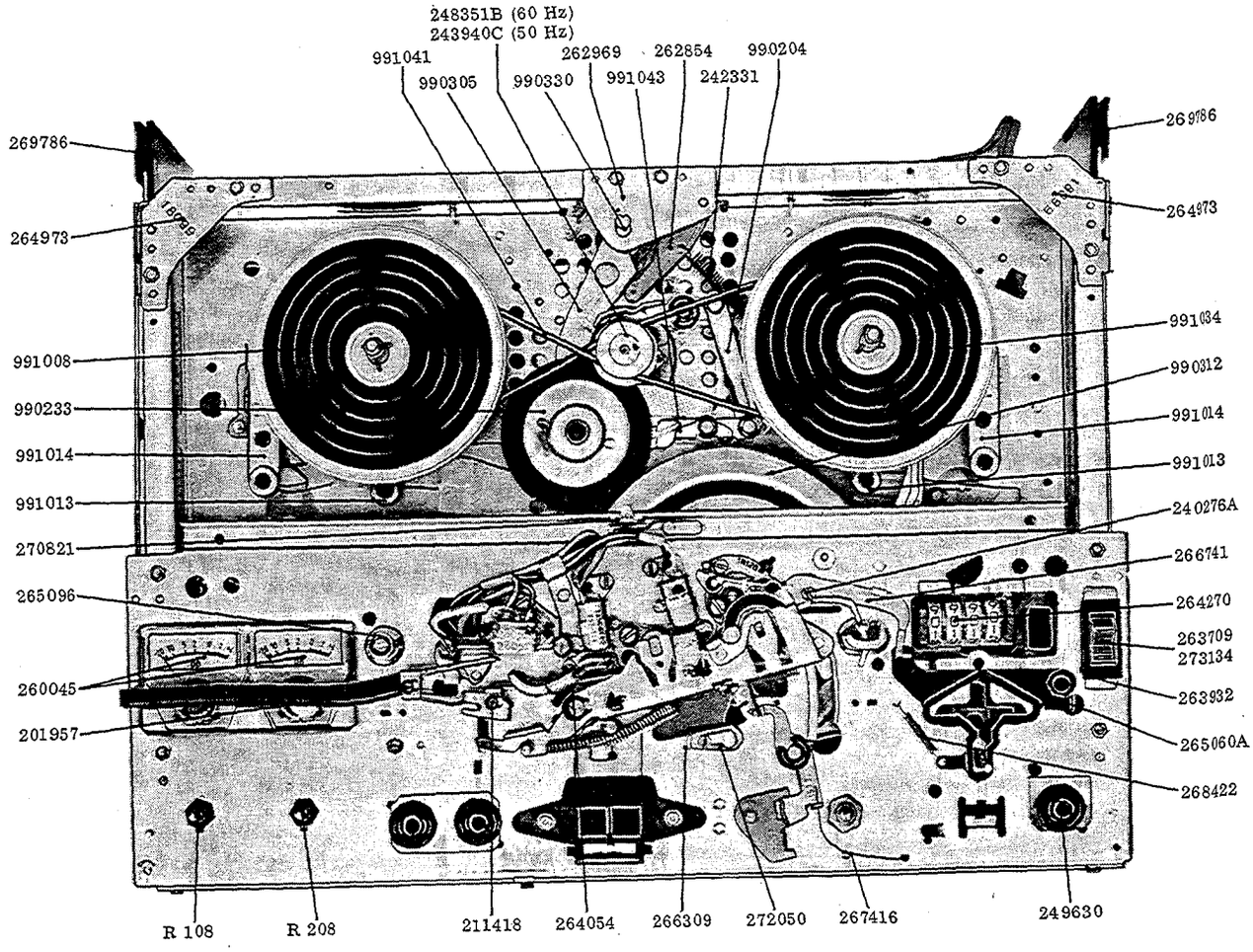


Fig. 12.10. Top view with covers removed.

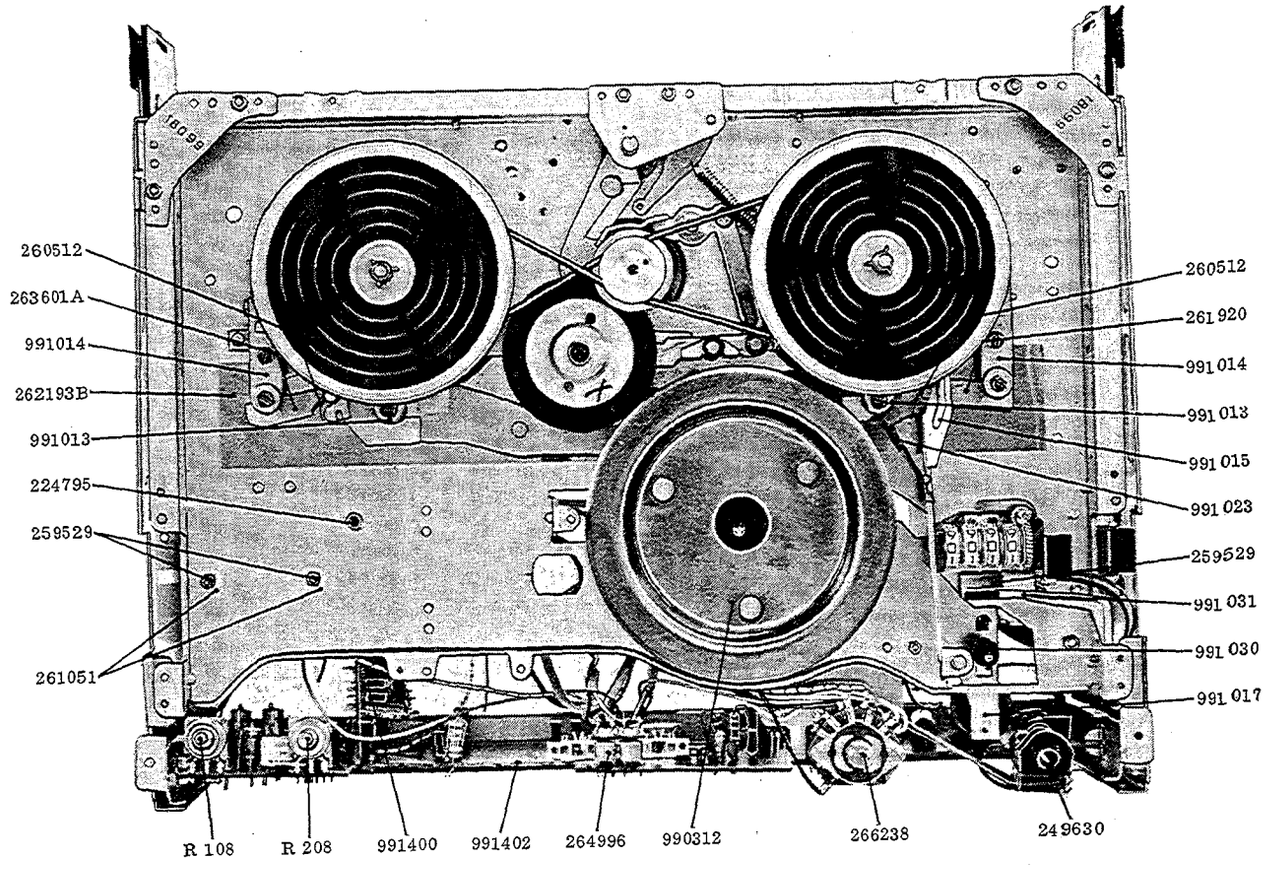


Fig. 12.11. Top view with upper mounting plate removed.

13.0 SPARE PARTS LIST FOR SERIES 3000X

The numbers of the mechanical parts on figures are identical with the part numbers in store. Part shown on figures without existing in the parts list are not available as spare parts alone.

Ordering of Parts

When ordering a mechanical part, it is essential that the appropriate part number being used as a reference in this manual, be specified.
For ordering of electrical components, however, the position number must be used.

Note: If modifications according to list are introduced from a certain serial number, this number must be specified.

13.1 Mechanical Parts

Part No.	Description	Fig. Ref.	Notes
201957	Shaft for pressure pad arm	12.10	
202008	Mains cable, 115 V, 7FT	12.8	
202151	Microswitch RX1 for end stop	12.5	
202309	Shaft for eccentric segment	12.5	
203250	Mains cable, 230 V 220 cm w/plug	12.7	
204013	Washer, 7,5 × 4,2 × 0,5 mm turbax	12.2, 12.3, 12.4	
207977	Delrin roller for indexing eccent. segment	12.4, 12.5	
208724	Clamp for mains cable		
209306	Spring for transfer wheel arm		
210622	Adjustment screw for bias head, 3 × 18 mm	12.4	
211339	Pulley for revolution counter	12.9	
211418	Shaft for lever operating pressure pad arm	12.10	
212036	Holder for operating lever ball	12.9	
212066	Nut for mounting of cabinet		
214270	Screw for adj. plate, spring pressure roller	12.4	
214895	Washer, 7,5 × 4,2 × 0,3 mm turbax	12.4	
215053	Pulley for turntable	12.3	
216734	Spring for cam disc		
218767	Nut for turntable shaft	12.2	
219234	Shaft for pressure roller arm assy.	12.6	
219816	Flange for turntable housing L&R	12.2, 12.3	
224795	Support for PW board	12.11	
229565	DIN-connector for microphone	12.5, 12.6	
230183	Shield for playback head	12.6	
230629B	Roller for speed selector arm	12.7, 12.8	
234478	Spring for bias head adjustment	12.4	
234960	Washer, speed selector knob.	12.1	
235420	Shaft for start/stop lever	12.4	
236045	Adj. plate for spring, pressure roller	4.2, 12.4	
236159A	Clamp for supporting motor	12.9	
240276A	Screw for end stop lever	12.6, 12.10	
240406A	Spring for record-playback head adjustment		
240879A	Bracket for transfer wire		
241009	Motor 110/220 V	12.9	
242331	Spring for cam disc arm	12.10	
242503	Tape feeler for end stop mechanism	12.6	
243013	Tape guide, right	12.6	
243150	Delrin arm for bias head adj.	12.4	
243940C	Motor pulley, 50 Hz	12.10	
243990	Spring for tape feeler, end stop mechanism	2.12, 12.5	

Part No.	Description	Fig. Ref.	Notes
244342A	Lever for end stop switch	12.5	
246231	Clamp for end stop switch wires	12.5	
247395	Clip 9 mm (3/8") for wires	12.9	
247941	Shaft for pressure roller	4.2, 12.4	
248027	Insulator for end stop switch	12.5	
248157	Bushing for adj. of tape guide		
248351B	Motor pulley, 60 Hz	12.10	
249068B	Box for motor	12.9	
249630	Connector for microphone and head set	12.6, 12.10, 12.11	
251130	Lever for pressure pad arm	12.6	
251489A	Tape support, left	2.7, 2.9, 12.6	
252115	Equalization switch	12.9	
252172	Lower bearing for flywheel		
252496	Clamp, link, equal. switch	12.9	
252754	Tape guide, adjustable	2.7, 2.9, 12.6	
254025	Pressure pad arm	2.7, 2.8, 2.9, 2.10, 12.6	
254779	Power transformer	12.9	
254844A	Support for pressure pad & tape	2.7, 2.9, 12.6	
257517	Drive belt for counter	12.9	
259529	Lamp for counter and meter 24 V 1 W	12.11	
259758	Phono connector for input board	12.7, 12.8	
259773	Bracket for fastening input board		
260045	Instrument, record and playback level indicator	12.10	
260289	Side plate, right	12.9	
260290	Tape support, right	12.6	
260325	Contact spring		
260361A	Tape tightening disc left	2.5, 12.2	
260512	Spring, brake lever left and right	12.11	
260577	Bearing for flutter filter	12.4	
260620A	Front panel	12.9	
260641	Knob for operating lever	12.1	
260700	Knob for cueing control arm	12.1	
260735	Tape guide, not adjustable	12.6	
260929	Rear cover plate	12.1	
260965	Spring for cueing control arm		
261051	Socket for lamp, indicator	12.11	
261094B	Index guide for operating lever	12.5	
261216	Adj. screw for clutch- and brake levers		
261303	Screw, 3 × 10 mm for front cover plate	12.1	
261460	Button for recording left channel	12.6	
261525	Stud for lifting arm		
261655	Screw, japanned, 3 × 10 mm for rear cover plate	12.1	
261805A	Coil spring for left friction disc	2.5, 12.2	
261841	Coil spring for clutch- and brake levers	2.1, 12.2, 12.3	
261885	Screw for feeler arm, end stop		
261920	Arm, brake right, acetal	12.11	
261970A	Bottom cover	12.8	
261992	Thrust disc for flywheel bearing		
262021	Arm, bias head	12.6	
262064	Teak cabinet	12.1	
262193B	Mylar slide plate	12.11	
262258	Flutter filter roller	12.4	
262322	Knob for speed selector	12.1	
262402	Contact spring for counter lamp holder		
262416	Shaft for start/stop knob		
262481	Tape braking arm, start/stop	12.6	
262509	Shield for indicator		

Part No.	Description	Fig. Ref.	Notes
262545	Holder for speed selector arm spring		
262732	Grommet for mains cable		
262739	Lower spring for operating lever	12.9	
262854	Speed selector arm	12.10	
262969	Bracket for speed selector	12.10	
262984	Screw 5/8" for cabinet	12.1	
263077	Spring for tape tightening disc	12.2	
263105A	Upper side plate, right	12.1	
263278	Bracket for power switch		
263393	Button for start/stop and function select. switch	12.1	
263443	Bracket for flywheel bearing		
263493A	Button for recording right channel		
263522A	Upper spring for operating lever		
263601A	Arm, brake left, acetal	12.11	
263688	Screw 3 × 8 mm c.sunk for rear cover plate	12.1	
263709	Button for power switch	12.10	Valid below ser.no. 2741076
263874	Bushing for operating lever		
263888	Power switch without button	12.9	Valid below ser.no. 2741076
263932A	Guide for power switch button	12.5, 12.10	Valid below ser.no. 2741076
264003	Side plate, left		
264054	Spring for bias head arm	12.10	
264075	Spring for clutch, take up turntable	12.3	
264083A	Bushing for friction disc	2.1, 12.2, 12.3	
264162	Rubber tape brake	12.6	
264226	Guide for slide arm		
264248	Button, volume	12.1	
264270	Revolution counter	12.10	
264420	Sleeve for slide arm damping		
264435	Felt ring for volume knob	12.1	
264564	Rosewood cabinet	12.1	
264578	Bracket for operating lever	12.9	
264593	Bushing for operating lever indexing		
264665	Screw for vertical mount.	12.1	
264786	Upper side plate, left	12.1	
264830	Rubber foot for vertical mount. leg		
264865	Terminal plug 7 pin, main ampl. board		
264866	Spring for tape brake arm	12.6	
264909	Post for pressure roller arm spring		
264930	Bracket for turntable brake levers	2.6	
264973	Reinforcing plate for rear corners	12.10	
264996	Function switch	12.9, 12.11	
265060A	Guide arm, end stop	12.5, 12.6, 12.10	
265096	Tape guide, left	12.10	
265146A	Rubber snap lock for reel		
265735A	Transistor cooling fin	12.9	
266072	Loose cover plate for rear connect.	12.1	
266087A	Spring for pressure roller	4.2, 12.4	
266238	Output switch	12.6, 12.11	
266309	Sleeve for end stop lever	12.10	
266439	Lever for instantaneous start/stop mechanism		
266540	Rear panel, European version	12.7	
266741	Arm for end stop mechanism	2.12, 12.10	
266791	Fork for instantaneous start-stop mechanism	12.4, 12.6	
266827	Guide plate for push buttons	12.6	
267373B	Coil spring for right friction disc	2.1, 12.3	
267416	Spring for inst. start/stop arm.	12.6, 12.10	
267768	Eccentric segment	12.5	
268062	Spring for pressure pad arm	2.7, 2.8, 2.9, 2.10, 12.6	
268120	Bracket for instantaneous start/stop		
268221	Rear panel, US version	12.8	
268422	Spring for end stop arm	12.6, 12.10	

Part No.	Description	Fig. Ref.	Notes
268472	Arm for instantaneous start/stop	12.1	
268975	Front cover plate	12.1	Valid below ser.no. 2741076
269097	Strap for transfer wire		
269112	Rubber foot		
269255	Screw for cover bracket 3 × 4 mm	12.1	
269449	Bracket PW-board	12.9	
269772	Walnut cabinet	12.1	
269786	Bracket for fastening rear cover pl.	12.6, 12.7, 12.8, 12.9, 12.10	
269801A	Shaft for inst. start/stop lever	12.6	
269902	Sound on Sound switch	12.7, 12.8, 12.9	
270469	Shaft for cover interlock		Valid above ser.no. 2733265
270821	Rear bracket for cover interlock	12.10	Valid above ser.no. 2733265
272050	Stop bracket for pressure roller arm	12.10	
272854	Right bracket for cover interlock	12.1	Valid above ser.no. 2733265
273134	Power switch	12.10	Valid above ser.no. 2741076
273407	Spring for fork, pressure roller arm	12.6	
273559	Window for counter	12.1	
273939	Return spring for pressure roller arm	12.6	
274162	DIN-connector for input-board	12.7	
274183	Spring for cover interlock		Valid above ser.no. 2733265
274535	Left bracket for cover interlock	12.1	Valid above ser.no. 2733265
277523	Front cover plate	12.1	Valid above ser.no. 2741076
990204	Parallel arm, complete		
990213	Holder for transfer wheel	12.6	
990233	Transfer wheel	12.6, 12.10	
990305	Arm for transfer wheel	12.10	
990312	Flywheel with capstan	12.6, 12.10	
990325	Pressure pad	2.7, 2.8, 2.9, 2.10, 12.6	
990330	Lifting cam disc w.shaft	12.10	
990334	Pressure roller	4.2, 12.4, 12.6	
990346	Bracket with shaft, end stop	12.5	
991006	Front tape path cover		Valid below ser.no. 2733265
991007	Rear tape path cover		Valid below ser.no. 2733265
991008	Supply turntable	2.5, 12.2, 12.10	
991009	Right clutch disc	2.1, 12.3	
991010	Left clutch disc	12.2	
991013	R & L clutch lever w.screw	2.1, 12.2, 12.3, 12.10, 12.11	
991014	R & L brake lever w.screw	2.6, 12.10, 12.11	
991015	Releasing arm w.pulling rod	12.11	
991017	Arm for clutch and brake slide	2.1, 2.6, 12.11	
991018	Cueing arm		
991021	Left turntable brake spring w.pad		
991022	Right turntable brake spring w.pad		
991023	Flywheel brake spring w.pad	12.11	
991024	Thrust spring for capstan		
991025	Housing for turntable bearing		
991026	Vertical mounting leg w.rubber feet		
991027	Upper flywheel bearing, compl.	12.5, 12.6	
991028	Record interlock plate w.shaft	12.6	
991030	Operating lever w.ball	12.11	
991031	Lamp holder for rev.counter	12.11	
991033	Mylar sheet w.felt	2.1, 12.3	
991034	Take-up turntable	2.1, 2.6, 12.3, 12.10	
991035	Tape tightening disc. Right	2.1, 12.3	
991038	Front tape path cover	12.1	Valid above ser.no. 2733265
991039	Rear tape path cover	12.1	Valid above ser.no. 2733265
991041	Rubber drive belt	12.10	
991042	Housing for rubber foot	12.8	
991046	Trafo for oscillator, T501	12.8	
991400	Board, main amplifier	12.9, 12.11	
991401	Board, connectors	12.9	
991402	Board, rectifier/oscillator	12.9, 12.11	
991404	Set of knobs, compl.		
991406	Pressure roller arm, compl.	12.4	

Screws, Washers, Nuts and Circlips

Screws

261885	2 × 5 mm
214270	2,6 × 4 mm
270002	2,6 × 10 mm
210556	3 × 3 mm
269255	3 × 4 mm
215951	3 × 5 mm
204809	3 × 8 mm
263688	3 × 8 mm
217632	3 × 10 mm
261303	3 × 10 mm
261655	3 × 10 mm
214336	3 × 12 mm
213918	3 × 15 mm
210622	3 × 18 mm
206908	3 × 20 mm
204658	4 × 6 mm
232367	3/16″ No. 4
200944	1/4″ No. 4
231267	1/4″ No. 4
227899	1/4″ No. 6
218675	3/8″ No. 4
269298	1/2″ No. 2
262984	5/8″ No. 6
213767	3/4″ No. 4
264665	7/8″ No. 6

Washers

230542	2,3 mm	DIN 6799
239651	3,2 mm	DIN 6799
204105	3,5 × 8,5 × 0,7 mm	
235937	4 mm	DIN 6799
211441	4,2 × 7,5 × 0,2 mm	Turbax
214895	4,2 × 7,5 × 0,3 mm	Turbax
204013	4,2 × 7,5 × 0,5 mm	Turbax
217856	5,2 × 7,5 × 0,2 mm	Turbax
200299	5,2 × 7,5 × 0,5 mm	Turbax

Nuts

209566	2,6 mm

Circlips

236346	2 mm
208431	3 mm
201003	4 mm
217540	5 mm
213826	6 mm

13.2 Electrical Components
Transistors

Ref. No.	Description	Notes
Q101 – 3000X	BC 149B	
Q102 – 3000X	BC 149B	
Q103 – 3000X	BC 149B	
Q104 – 3000X	BC 147B	
Q201 – 3000X	BC 149B	
Q202 – 3000X	BC 149B	
Q203 – 3000X	BC 149B	
Q204 – 3000X	BC 147B	
Q301 – 3000X	BC 148A	
Q302 – 3000X	BC 148A	
Q303 – 3000X	BC 107B	
Q304 – 3000X	BC 147B	
Q305 – 3000X	BC 149B	
Q306 – 3000X	BC 149B	
Q307 – 3000X	BC 147B	
Q308 – 3000X	BC 148A	
Q309 – 3000X	BC 107B	
Q401 – 3000X	BC 148A	
Q402 – 3000X	BC 148A	
Q403 – 3000X	BC 107B	
Q404 – 3000X	BC 147B	
Q405 – 3000X	BC 149B	
Q406 – 3000X	BC 149B	
Q407 – 3000X	BC 147B	
Q408 – 3000X	BC 148A	
Q409 – 3000X	BC 107B	

Ref. No.	Description	Notes
Q501 – 3000X	2N 4921	
Q502 – 3000X	2N 4918	
Q503 – 3000X	BC 147B	
Q504 – 3000X	BC 147B	
Q505 – 3000X	BC 147B	
Q506 – 3000X	BC 147B	
Q507 – 3000X	BC 107B	
Q508 – 3000X	2N 4919	

Diodes

Ref. No.	Description	Notes
D502 – 3000X	1N 4148	Zener diode 27 V
D503 – 3000X	1N 5254B	
D504 – 3000X	1N 4148	

Potentiometers

Ref. No.	Description	Notes
R108 – 3000X	10 kohm	Pos. log.
R208 – 3000X	10 kohm	Pos. log.
R333 – 3000X	10 kohm	Linear
R351 – 3000X	10 kohm	Linear
R433 – 3000X	10 kohm	Linear
R451 – 3000X	10 kohm	Linear
R501 – 3000X	250 kohm	Pos. log.
R502 – 3000X	250 kohm	Pos. log.

Trimming Capacitors

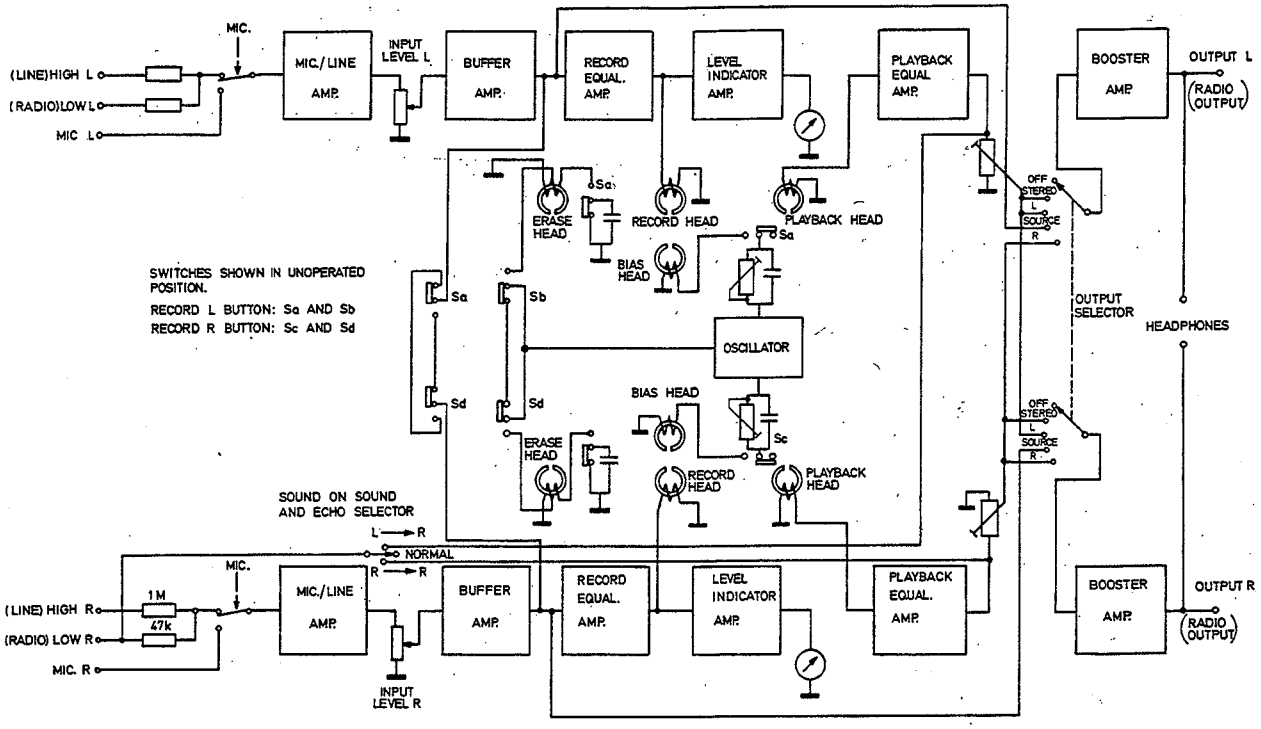
Ref. No.	Description	Notes
C508 – 3000X	150 – 750pF	

14.0 TABLE OF TRANSISTORS USED IN MODEL 3000X

CHANNEL	TRANSISTOR REF. NO.										
L	Q101, Q102, Q103,	BC149B BC149C		BC209B BC209C							
R	Q201, Q202, Q203										
L	Q405, Q406	BC149B BC149C		BC209B BC209C							
R	Q305, Q306,										
L	Q104, Q404, Q407				BC147B BC147C	BC107B BC107C	BC207B BC207C				
R	Q204, Q304, Q307										
L	Q403, Q409					BC107B BC107C					
R	Q303, Q309										
L	Q401, Q402, Q408		BC208A BC208B BC208C					BC148A BC148B BC148C			
R	Q301, Q302, Q308										
	Q501								2N4921		
	Q502									2N4918	2N4919
	Q503				BC147B BC147C	BC107B BC107C	BC207B BC207C				
	Q504, Q505				BC147B BC147C	BC107B BC107C	BC207B BC207C				
	Q506				BC147B BC147C	BC107B BC107C	BC207B BC207C				
	Q507					BC107B BC107C					
	Q508										2N4919

Note: Two or more types of transistors, located in same frame, indicate equivalent types.

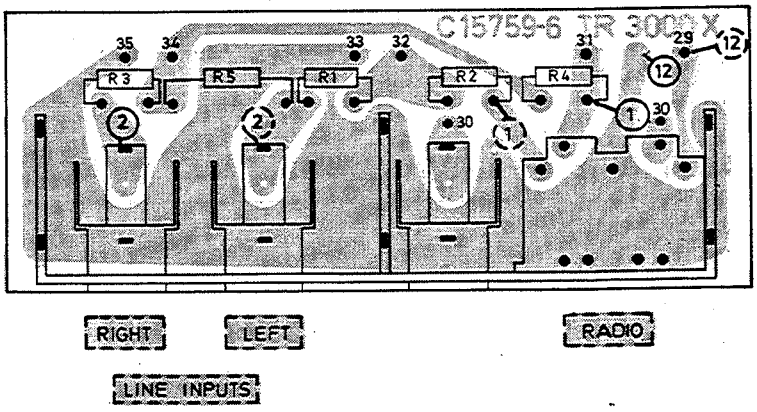
15.0 BLOCK DIAGRAM FOR MODEL 3000X



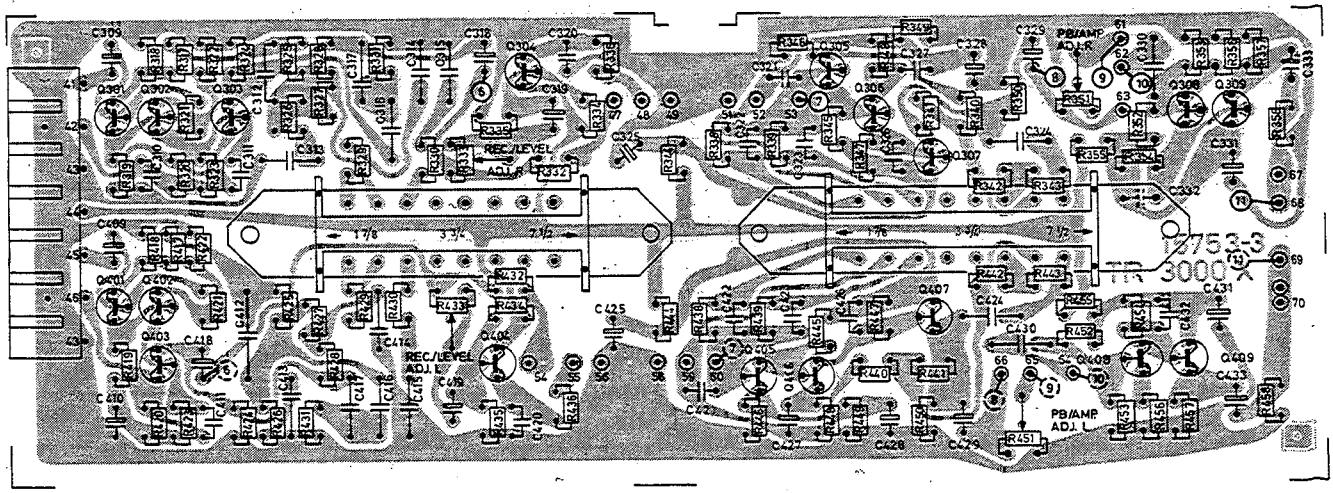
16.0 PRINTED WIRING BOARDS AND CIRCUIT DIAGRAMS

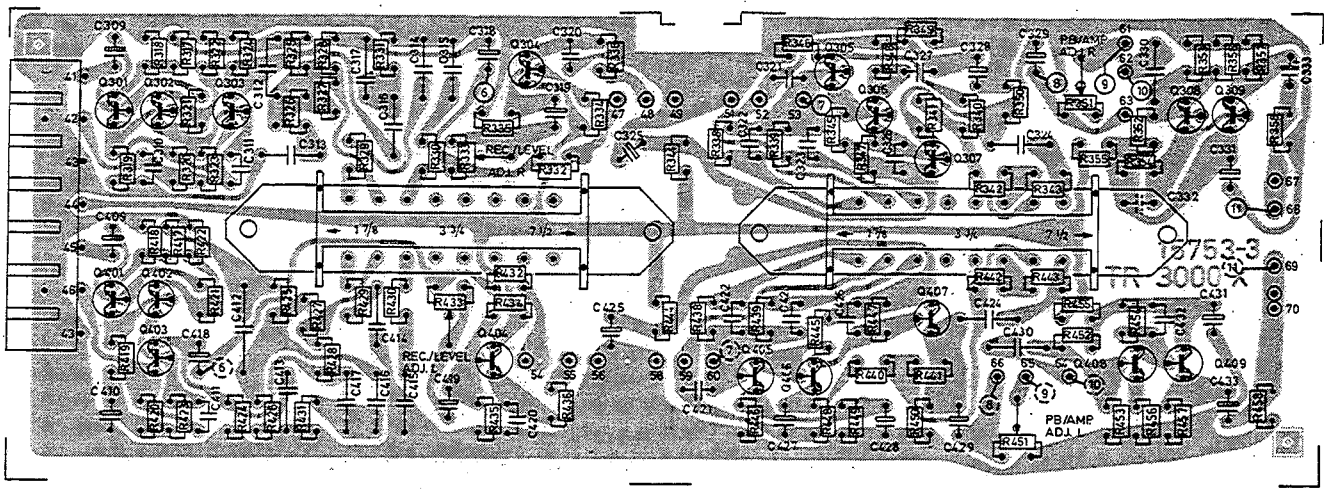
16.1 European Version

Input and output terminal board. Printed side.



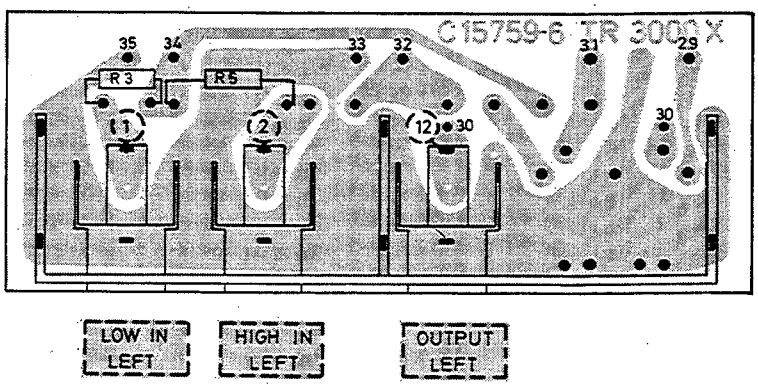
Board for record/playback equalizing amplifiers, level indicator amplifiers and booster amplifiers. Printed side.



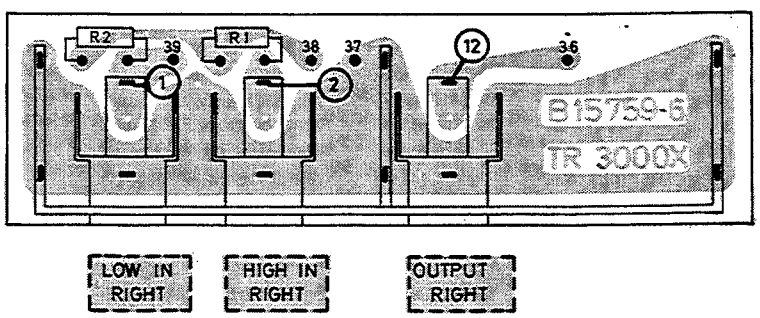


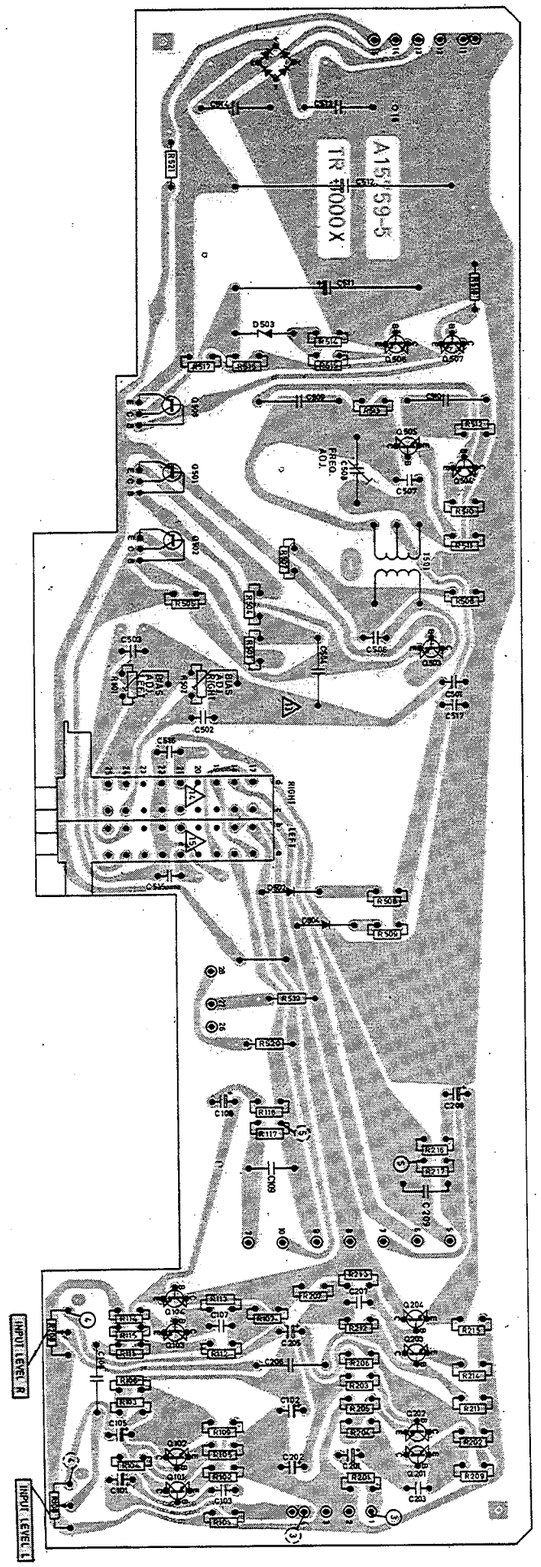
Board for record and playback equalizing amplifiers, level indicator amplifiers and booster amplifiers. Printed side.

Input and output terminal board for channel L. Printed side.

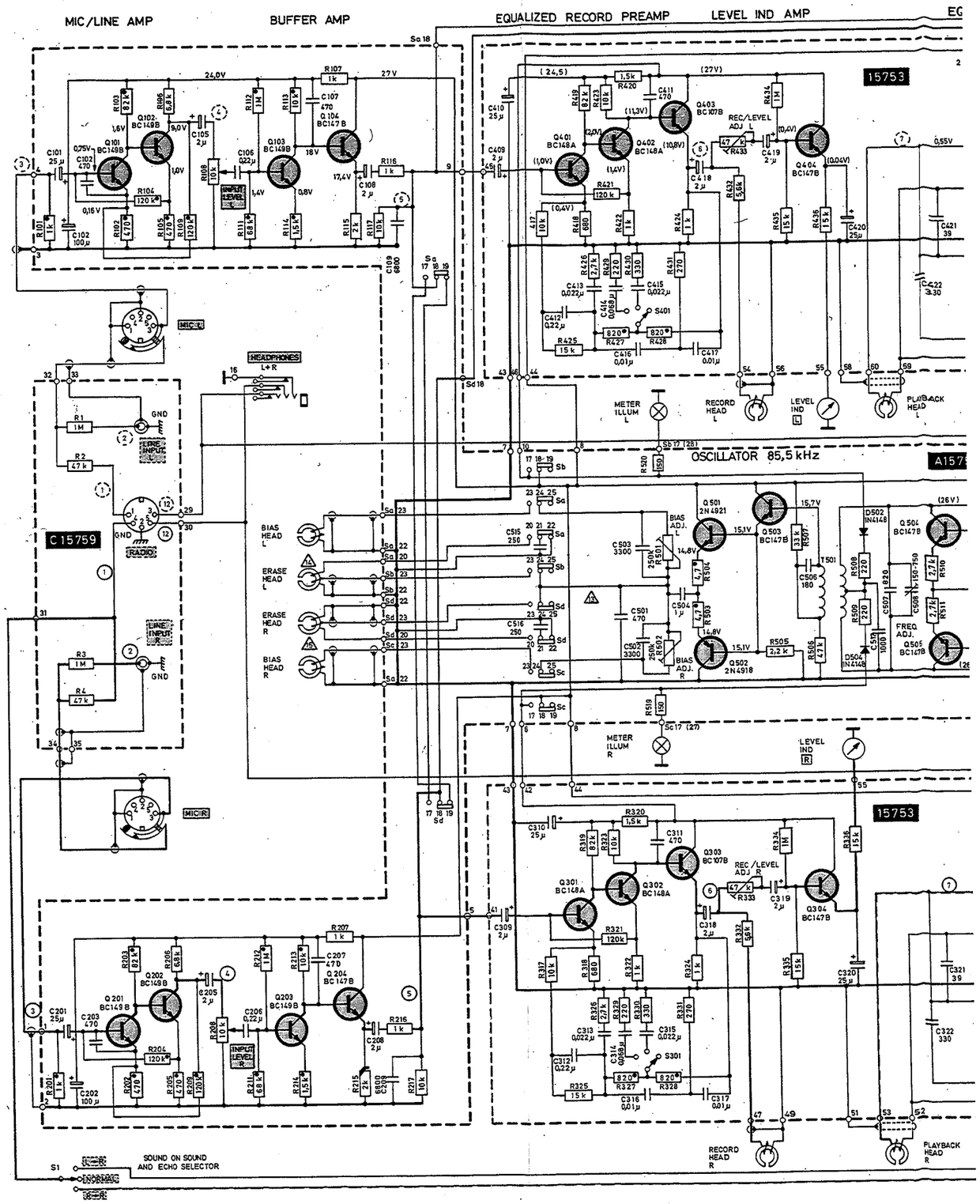


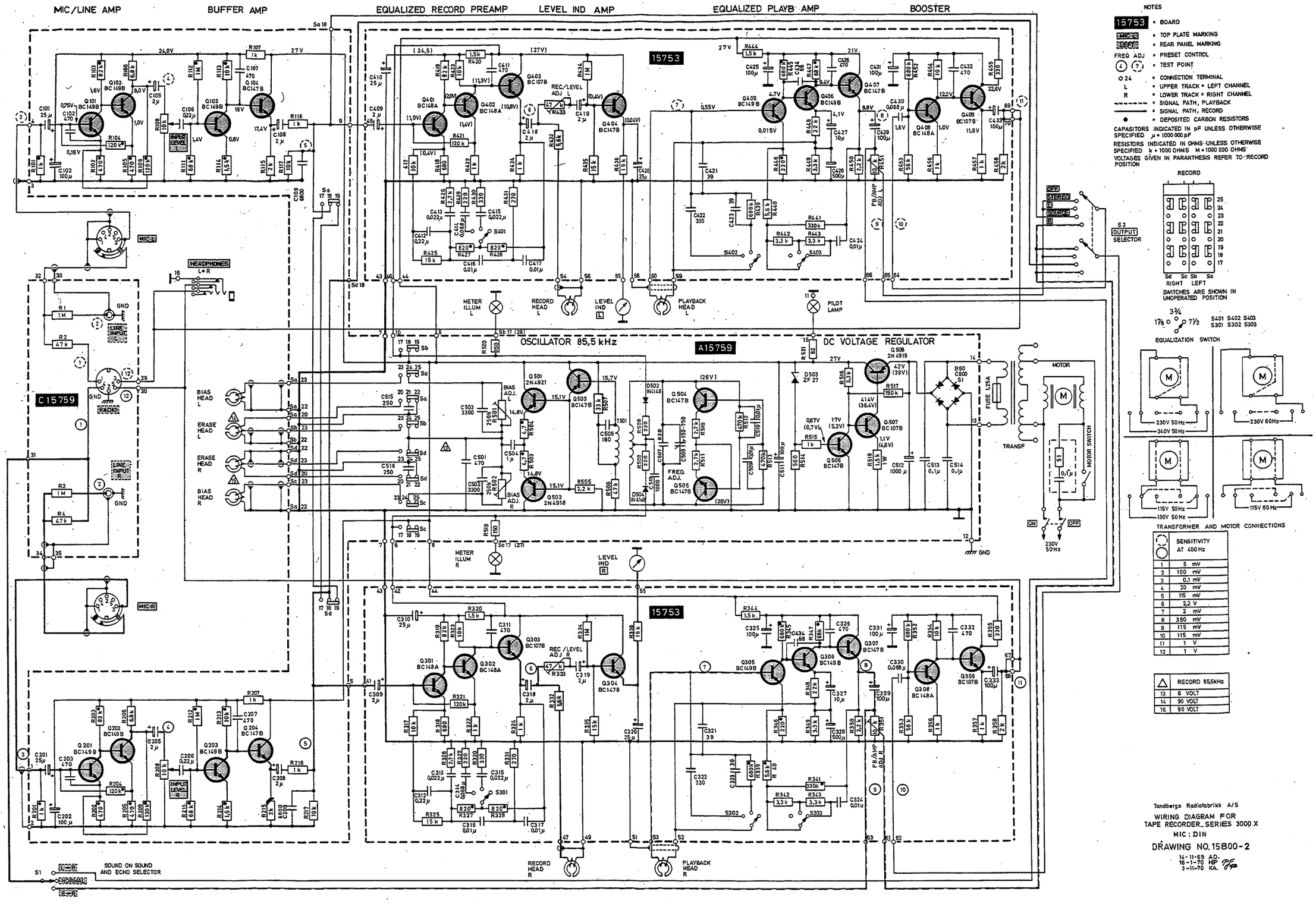
Input and output terminal board for channel R. Printed side.



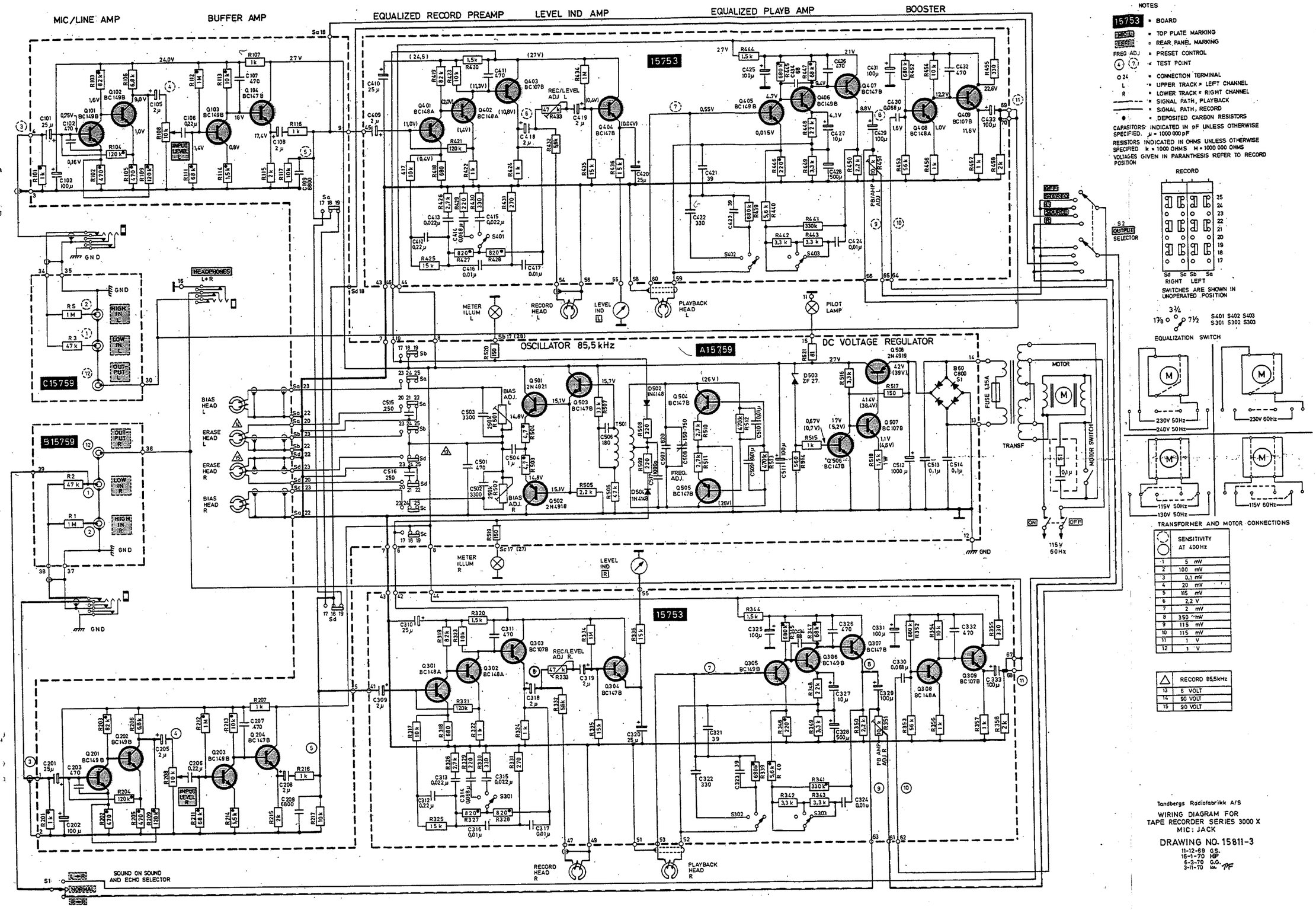


Board for mic./lire amplifiers, buffer amplifiers, oscillator, bias and DC voltage regulator. Printed side.




MIC/LINE AMP
BUFFER AMP
EQUALIZED RECORD PREAMP
LEVEL IND AMP
EQUALIZED PLAYB AMP
BOOSTER
15753
A15759
C15759
OSCILLATOR 85,5 kHz
DC VOLTAGE REGULATOR
MIC L
MIC R
HEADPHONES
LINE INPUT
RADIO
INPUT LEVEL
METER ILLUM L
RECORD HEAD L
LEVEL IND L
PLAYBACK HEAD L
PILOT LAMP
BIAS HEAD L
ERASE HEAD L
ERASE HEAD R
BIAS HEAD R
METER ILLUM R
LEVEL IND R
RECORD HEAD R
PLAYBACK HEAD R
REC/LEVEL ADJ L
REC/LEVEL ADJ R
FREQ. ADJ.
BIAS ADJ.
PB/AMP ADJ L
PB/AMP ADJ R
S1 SOUND ON SOUND AND ECHO SELECTOR
S2 OUTPUT SELECTOR
S401 S402 S403
S301 S302 S303
EQUALIZATION SWITCH
MOTOR
MOTOR SWITCH
TRANSF
FUSE 1,25A
RECORD
RIGHT LEFT
TRANSFORMER AND MOTOR CONNECTIONS
NOTES
15753 = BOARD
= TOP PLATE MARKING
= REAR PANEL MARKING
FREQ ADJ = PRESET CONTROL
= TEST POINT
= CONNECTION TERMINAL
L = UPPER TRACK = LEFT CHANNEL
R = LOWER TRACK = RIGHT CHANNEL
= SIGNAL PATH, PLAYBACK
= SIGNAL PATH, RECORD
= DEPOSITED CARBON RESISTORS
CAPASITORS INDICATED IN pF UNLESS OTHERWISE SPECIFIED µ = 1000 000 pF
RESISTORS INDICATED IN OHMS UNLESS OTHERWISE SPECIFIED k = 1000 OHMS M = 1000 000 OHMS
VOLTAGES GIVEN IN PARANTHESIS REFER TO RECORD POSITION
SWITCHES ARE SHOWN IN UNOPERATED POSITION
SENSITIVITY AT 400 Hz
1 5 mV
2 100 mV
3 0,1 mV
4 20 mV
5 115 mV
6 2,2 V
7 2 mV
8 380 mV
9 115 mV
10 115 mV
11 1 V
12 1 V
RECORD 85,5kHz
13 6 VOLT
14 90 VOLT
15 90 VOLT
Tandbergs Radiofabrikk A/S
WIRING DIAGRAM FOR TAPE RECORDER SERIES 3000 X
MIC : DIN
DRAWING NO. 15800-2
14-11-69 AO.
16-1-70 HBP
3-11-70 KA.

16.2 U.S. Version



NOTES

15753 = BOARD
= TOP PLATE MARKING
= REAR PANEL MARKING
FREQ ADJ = PRESET CONTROL
④ ⑦ = TEST POINT
O 24 = CONNECTION TERMINAL
L = UPPER TRACK = LEFT CHANNEL
R = LOWER TRACK = RIGHT CHANNEL
= SIGNAL PATH, PLAYBACK
= SIGNAL PATH, RECORD
● = DEPOSITED CARBON RESISTORS

CAPASITORS INDICATED IN pF UNLESS OTHERWISE SPECIFIED. μ = 1000 000 pF

RESISTORS INDICATED IN OHMS UNLESS OTHERWISE SPECIFIED k = 1000 OHMS M = 1000 000 OHMS

VOLTAGES GIVEN IN PARANTHESIS REFER TO RECORD POSITION

	SENSITIVITY AT 400Hz
1	5 mV
2	100 mV
3	0,1 mV
4	20 mV
5	115 mV
6	2,2 V
7	2 mV
8	350 mV
9	115 mV
10	115 mV
11	1 V
12	1 V

△	RECORD 85,5kHz
13	6 VOLT
14	90 VOLT
15	90 VOLT

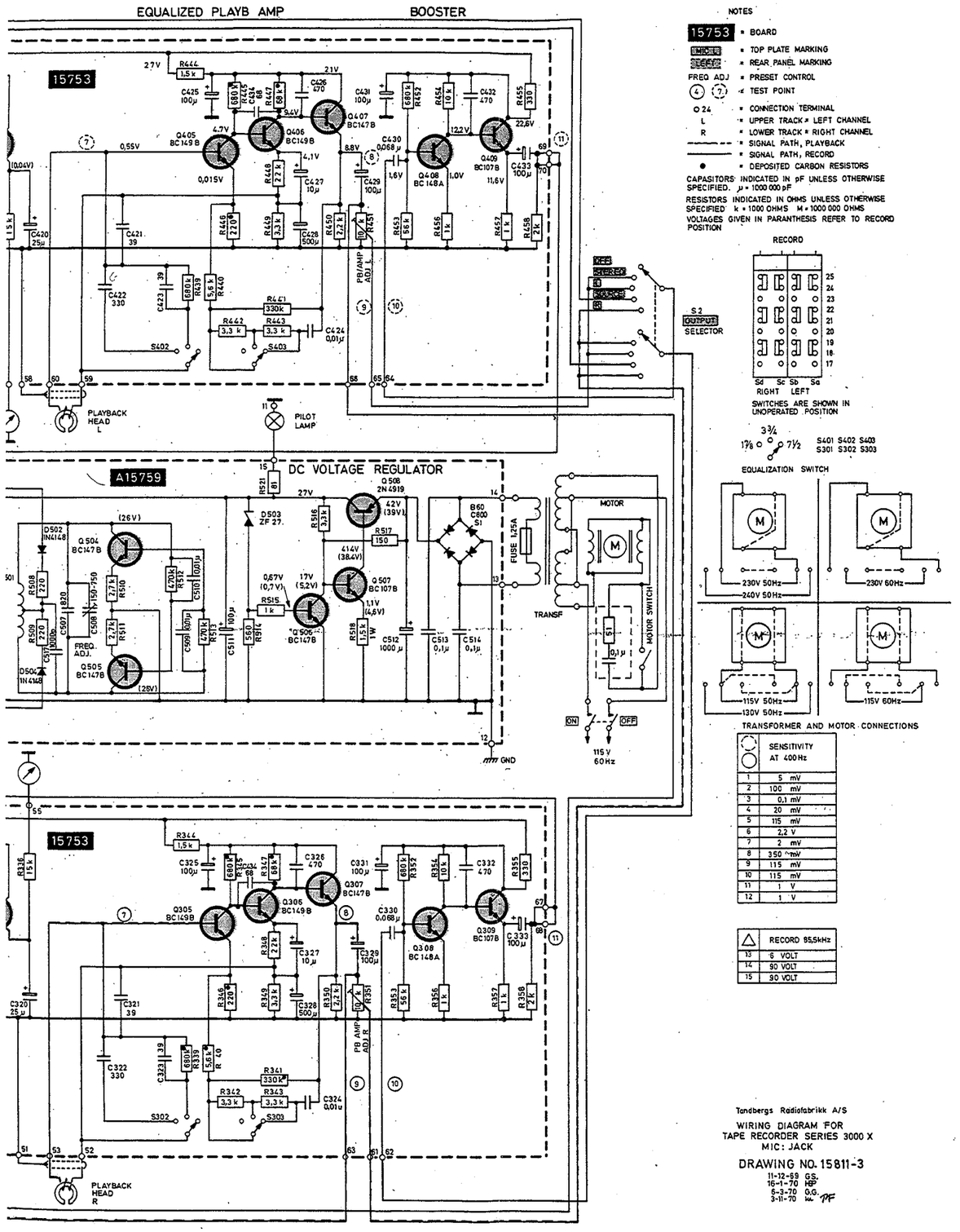
Tandbergs Radiofabrikk A/S

WIRING DIAGRAM FOR TAPE RECORDER SERIES 3000 X MIC: JACK

DRAWING NO. 15811-3

11-12-69 GS.
16-1-70 HBP
6-3-70 G.G.
3-11-70 MK

Board f
oscillat
Printed



NOTES

15753 = BOARD

EMOKE = TOP PLATE MARKING

REAR = REAR PANEL MARKING

FREQ ADJ = PRESET CONTROL

④ ⑦ = TEST POINT

O 24 = CONNECTION TERMINAL

L = UPPER TRACK = LEFT CHANNEL

R = LOWER TRACK = RIGHT CHANNEL

——— = SIGNAL PATH, PLAYBACK

——— = SIGNAL PATH, RECORD

● = DEPOSITED CARBON RESISTORS

CAPASITORS INDICATED IN pF UNLESS OTHERWISE SPECIFIED. µ = 1000 000 pF

RESISTORS INDICATED IN OHMS UNLESS OTHERWISE SPECIFIED k = 1000 OHMS M = 1000 000 OHMS

VOLTAGES GIVEN IN PARANTHESIS REFER TO RECORD POSITION

	SENSITIVITY AT 400Hz
1	5 mV
2	100 mV
3	0,1 mV
4	20 mV
5	115 mV
6	2,2 V
7	2 mV
8	350 ^mV
9	115 mV
10	115 mV
11	1 V
12	1 V

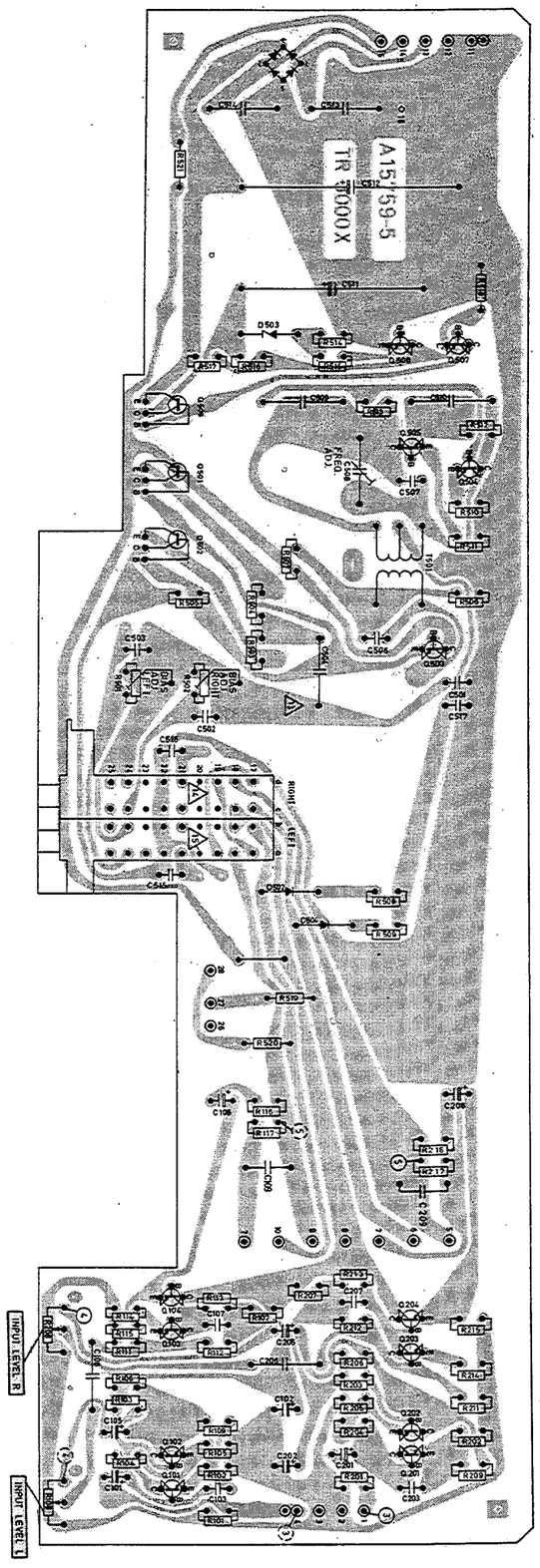
△	RECORD 95,5kHz
13	6 VOLT
14	90 VOLT
15	90 VOLT

Tandbergs Radiofabrikk A/S

WIRING DIAGRAM FOR TAPE RECORDER SERIES 3000 X MIC: JACK

DRAWING NO. 15811-3

11-12-69 GG.
16-1-70 HBP
6-3-70 G.G.
3-11-70 PF



Board for mic./lire amplifiers, buffer amplifiers, oscillator, bias and DC voltage regulator.
Printed side.